INDUSTRY AND POWER

For Executives and Engineers Responsible For Engineered Plant Services

MAY 1952

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ARMSTRONG "BLAST" TRAPS SPEED UP HEATING

of Single Pipe Coils, On-and-Off Multiple Coils, Unit Heaters, etc.

IN equipment where large amounts of air accumulate when the steam is turned off, and where the air can be pushed out ahead of the steam, Armstrong "Blast" Traps provide remarkably fast heat-up. A corrosion resistant invar and stainless bi-metal strip holds open a very large vent which lets air whistle right through the trap when equipment or lines are cold. As soon as steam reaches the trap, the bi-metal closes the big vent.

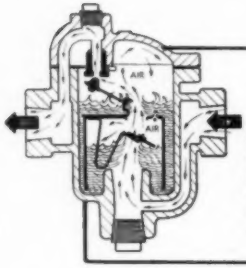
Armstrong Blast Traps combine the benefits of quick heat-up with the dependable service of mechanical traps. There is no bellows to leak or collapse due to high pressure. In fact, the traps are hydraulically tested at 500 lbs. pressure before they leave the factory.

Call your nearby Armstrong Representative for details and prices.

ARMSTRONG MACHINE WORKS

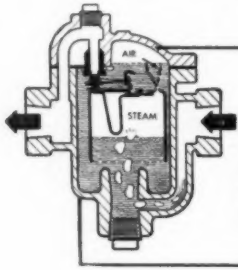
820 Maple Street • Three Rivers, Michigan

AIR WHISTLES RIGHT THROUGH



VENT OPEN

Note large air bubbles "whistling" through large thermic-control vent to be discharged with condensate through open trap valve. Shaded grey area is condensate.



VENT CLOSED

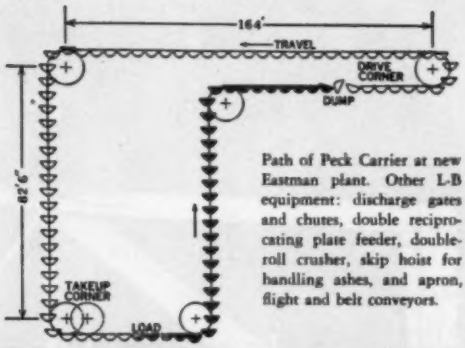
After accumulated air and condensate are discharged, large vent closes. Small vent is always open to handle ordinary volume of air entering trap.

THE ARMSTRONG STEAM TRAP BOOK tells all about Armstrong Blast and Standard Traps—where to use them and how to select and install them. You are welcome to a copy. Just write for it.

SEE OUR CATALOG IN SWEET'S

ARMSTRONG STEAM TRAPS

Eastman repeats after 22 years ...orders another Peck Carrier!



Path of Peck Carrier at new Eastman plant. Other L-B equipment: discharge gates and chutes, double reciprocating plate feeder, double-roll crusher, skip hoist for handling ashes, and apron, flight and belt conveyors.

Proof that LINK-BELT's unified responsibility cuts power plant coal handling costs

When Eastman Kodak Co. enlarged their Rochester (N.Y.) power plant recently, they again called in Link-Belt. They wanted the same efficient coal handling they are getting in their 1929-built plant, to assure uninterrupted supply of process steam 24 hours a day.

The new system—also built around a Link-Belt Peck Carrier—handles 130 tons of coal per hour. Because the Peck Carrier moves coal vertically as well as horizontally, without transfer points, all costs are extremely low—initial, operating and maintenance.

Eastman's versatile carrier can be emptied over a belt conveyor by a stationary tripper to serve the old steam plant. Or, with a movable tripper, coal can be discharged at any point on the upper run to fill the new bunkers uniformly.

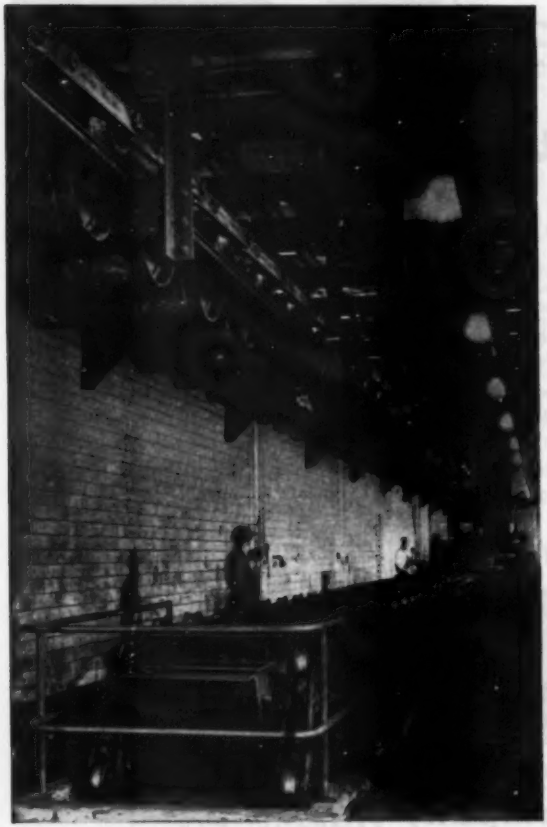
Remember, too, Link-Belt designs and builds complete coal handling systems for large or small plants. One source . . . one responsibility. Ask your Link-Belt representative for a copy of new Power Plant Book 2410.

LINK-BELT

COAL HANDLING EQUIPMENT

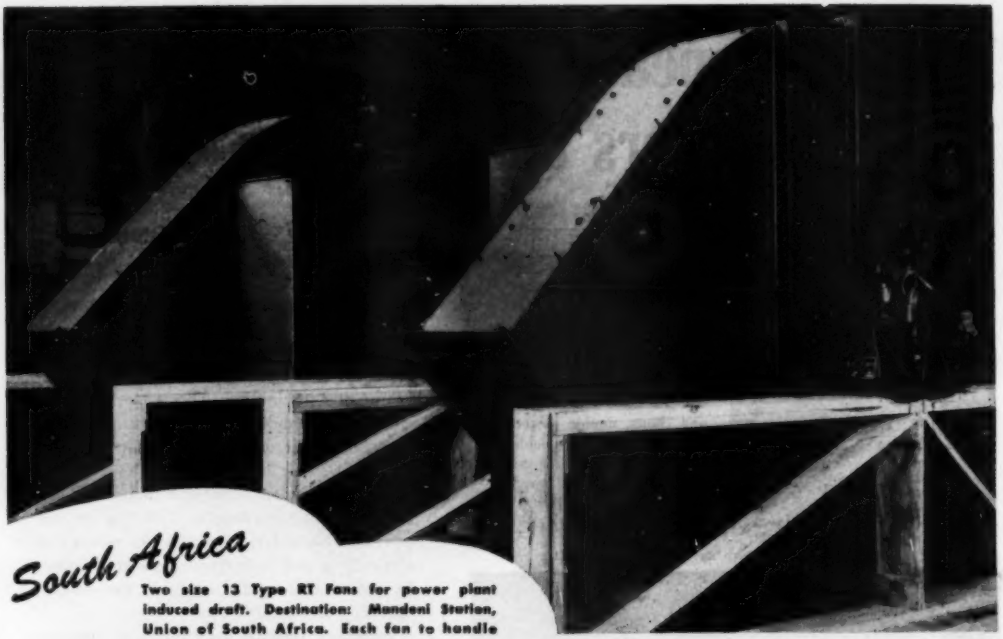
LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices in Principal Cities.

12,776



Upper horizontal run of Peck Carrier serves new coal bunkers. Use of L-B Electrofluid Drive cuts motor size from 30 to 20 hp.

Note full loading of buckets being automatically discharged by tripper. Buckets stay horizontal in any travel direction.



South Africa

Two size 13 Type RT Fans for power plant induced draft. Destination: Mondeni Station, Union of South Africa. Each fan to handle 48,300 c.f.m. of flue gases at over 500° F.

Clarage HEAVY-DUTY Induced Draft Fans Travel a Long Way to Make Good

SEND FOR CATALOG 901

Type RT Fan specifications and equipment arrangements for induced draft, forced draft and industrial air handling services are covered in this catalog. Write for your copy today.

Shipped five months ago, these Type RT Fans are now in operation almost halfway around the world from Clarage service . . .

But whether you are 50 miles from us — or 10,000 — makes little difference when you install Type RT fan equipment.

Every RT fan part — wheels, bearings, shaft, housing — is HEAVY-DUTY construction. You are not likely to need repair parts for a long time to come!

That is why this excellent mechanical draft equipment is now operating in 43 states and 15 foreign countries.

YOU CAN RELY ON

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HEADQUARTERS FOR AIR HANDLING & CONDITIONING EQUIPMENT

Clarage Fan Company 635 PORTER STREET *KALAMAZOO, MICH.*

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

Edited specifically for executives and engineers responsible for the selection, installation, operation & maintenance of equipment required for Engineered Plant Services*

INDUSTRY AND POWER

The Magazine for Engineered Plant Services

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***Engineered Plant Services**

By *Engineered Plant Services* we mean the *providing* or *generating, transmitting, controlling, applying,* and *maintaining* of POWER, STEAM, MECHANICAL DRIVES, HEAT, ELECTRICITY, AIR, WATER, and other engineered services in and for all areas of the industrial establishment as required for production and operation. This includes Lubrication, Piping Systems, Industrial Waste Disposal, Corrosion Control, Electrical Systems, Industrial Heat, Coal and Bulk Handling, Dust and Fume Control, and other related services of an engineering nature.

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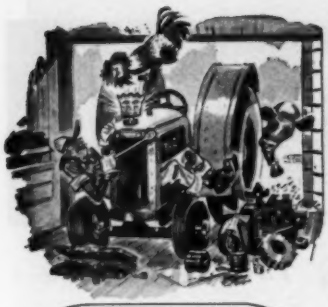
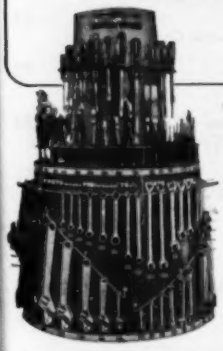


They Know Where e'er King Tractor Rules... that

PROTO means PROfessional TOols!



The PROTO Line Includes Wrenches of All Types, Pliers, Screwdrivers, Punches, Chisels, Sockets & Handles, Pullers, Tool Boxes, Industrial Tools and Many Others.

There are several reasons why *all* tool experts prefer PROTO *professional* tools. User-tested designs provide strength, lightness and ease of handling. PROTO-specified alloy steels, properly forged and heat treated, insure extra life. Modern manufacturing produces accurate tools for fast, safe use. And the guarantee protects buyers. Choose the *professional* tools you need from the complete line at your PROTO dealer's store. Send 10¢ for 68-page catalog to

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LOS ANGELES

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Acorns of science

Developments not yet available, but of interest to those responsible for Engineered Plant Services

Nickel Coated Aluminum

● A new method for coating aluminum with a hard yet resilient nickel plating uses a synthetic rubber base sprayed on the base metal to the required thickness to establish a bond. After drying, nickel is plated on the piece by conventional means. Plate thickness depends on requirements. Efficiency of the process, developed by United Aircraft Corporation and Bart Laboratories Co., Inc., has been shown in tests on propeller blades. High pressure streams of water and cinders left coated blades unharmed, eroded away approximately 20 per cent of the tip area of uncoated blades.

New Source of Sound

● A loudspeaker without the conventional mechanical diaphragm is being tested by the Institute of Inventive Research. A heated platinum electrode is used to produce an ionic cloud which will expand and contract in response to changes in a high frequency field.

Dielectric Amplifiers

● Joining the large group of amplifier types such as the saturable reactor, recently raised to the dignity of a magnetic amplifier, and the transistor, the newest member is the dielectric amplifier. Made from a select group of materials such as barium titanate, strontium titanate and lead zirconate, as reported by Arthur D. Little, Inc., signals entering the dielectric amplifier change resistance to current flow by changing capacitance.

Uses Wanted

● Often an experimental product is fully developed but finds itself without applications that appear worthy of its properties. Minnesota Mining and Manufacturing Company's new material is a rubber coated fabric covered with microscopic glass beads on both sides. When tested as a cushioning flat washer, the surfaces showed very low coefficient of friction, distributed pressure evenly, and showed no evidence of scoring. The material can be used with or without lubricant, and the glass spheres act as a reservoir for oil. Further developments may occur outside the company, which is offering samples for testing.

Plating Potentials Regulated

● Patent No. 2,584,816 describes an electronic electroplating control system which will maintain a constant potential between cathode and plating solution despite various changes in conditions which may occur during the plating operation.

Vertical Pipe Extractor

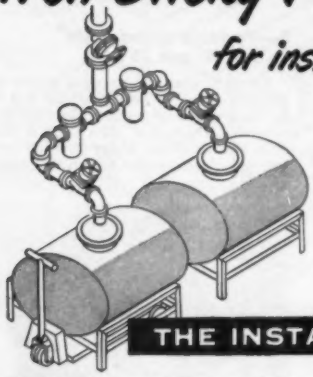
● Patent No. 2,584,801 discloses a clamp for extracting vertical pipes from inaccessible locations. The clamp, which may be suspended from the end of a single supporting cable, is operated by remote control to lower it into the end of the pipe and is then manipulated to grip and remove it.

Capacitor Light Improvement

● Capacitor light sources, in which a phosphor used as a dielectric between conducting layers, one of which is transparent, is made to glow by an alternating potential applied to plates, are very inefficient. However, two General Electric engineers report that single crystals of the phosphor may be made to glow, yielding many times as much light as with the powder. This may improve source efficiency.

Do Your Valves Fit Your Job This Well?

... on Sticky Fluid for instance



THE INSTALLATION

Crane Diaphragm Valves on air pressurized liquid latex piping service in paint factory, Adams & Elting Division, The Glidden Company, Chicago.

VALVE SERVICE RATINGS

OPERATION:	Easy - No sticking
SUITABILITY:	Fluid can't get into bonnet
MAINTENANCE COST:	None to date - None indicated
SERVICE LIFE:	No sign of wear
OPERATING RESULTS:	Production delays stopped
PRICE:	In line - No premium
AVAILABILITY:	Stock item in Crane line

THE HISTORY

Conventional valves formerly used in this service were hindered by exposure of working parts to the line fluid. The sticky latex would accumulate in the bonnet and stem threads, freezing the stem, and making valve operation difficult or impossible. With 10 or more operating cycles required daily, the plant faced considerable valve trouble and maintenance expense

Both trouble and maintenance cost were completely eliminated by replacing with Crane Diaphragm Valves. Their fully sealed bonnet keeps the latex out of working parts. They operate smoothly and do not freeze or stick. So well is the customer satisfied with Crane Diaphragm Valves, more have been ordered for new latex lines.

THE VALVE

Crane No. 1610 Iron Body Packless Diaphragm Valves featuring separate disc and diaphragm. Neoprene diaphragm acts as bonnet seal only; isn't pinched or stressed when valve is closed. Conventional type seating makes positive closure even should diaphragm fail. High flow capacity Y-pattern body has non-restricting interior design. Available unlined or fully Neoprene lined. Consult your Crane Catalog or Crane Representative.

The Complete Crane Line Meets All Valve Needs. That's Why
More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
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VALVES • FITTINGS • PIPE • PLUMBING • HEATING

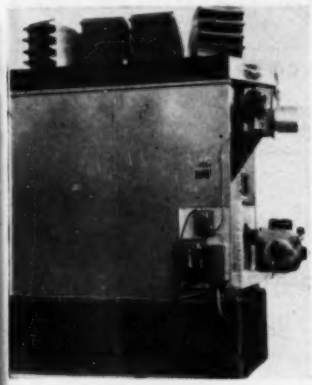
New equipment and developments

Highlights of new products by leading manufacturers

Each new product item has a key number for your convenience in asking for additional, detailed information. Insert key number on return post card on page 131

1—Space heaters feature compact design

The Thermobloc Div. of Prat-Daniel Corp. has announced the Model 2000 Thermobloc space heater, designed for industrial applications. Maximum output is 2,000,000 Btu per hr. Compact de-



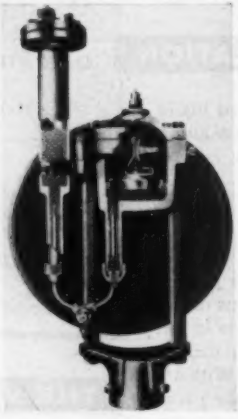
sign is featured. Diffuser, permitting pin-point control of air throw, can be rotated 360 degrees. Ducts can also be attached. Normal air output is 22,000 cfm. A combination gas and oil burner, or light fuel oil, heavy oil or gas burner can be supplied.

2—Mercury lamps have built-in reflectors

Two mercury lamps having built-in reflectors have been introduced by the Lamp Div. of General Electric Co. Since little or no cleaning or other maintenance is required, they are of advantage in industrial areas in which dirt normally causes severe reductions in light levels or where lamps can be reached only with difficulty. They also provide a solution where existing lamp fixtures have depreciated badly. Produced in 400 w size, the lamps have a life rating of 3000 hr at 5 hr per burning start, and 4000 hr at 10 hr per start. A mechanical type mogul screw base is used. One lamp, the H400-R1, generates light of regular mercury color. Lumen output is 14,500. The other, the H400-RC1, 10,000 lumens, employs a coating to improve color quality, particularly in its effect upon human complexion.

4—Recording flow meter has improved design

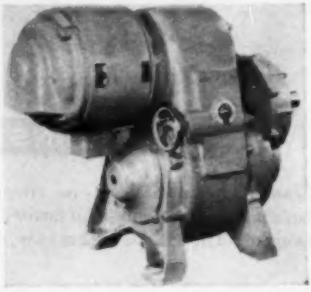
Higher sustained accuracy and easier maintenance result from an improved design of the Type 27 recording flow



meter manufactured by The Foxboro Co. A pressure sealed bearing is employed to eliminate lubrication. Plastic check floats are submerged in mercury, and the U-bend has metal-to-metal compression seals to prevent mercury loss. Damping adjustments are simplified and a new type ball-chain eliminates friction and errors of angularity.

5—Variable speed units for 20 and 25 hp

Variable speed units with single reduction gears in ratings of 20 and 25 hp have been announced by Sterling Electric Motors, Inc. The Type KFEA units are for speeds lower thas 728 rpm, with speed adjustment within the ranges



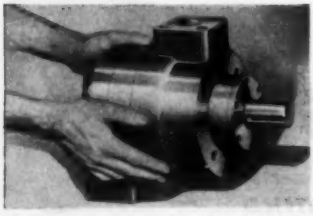
of 2:1, 3:1 or 4:1. Features include positive pulley adjustment, constant speed, positive oil seals and direct-through ventilation. Either drip-proof or splash-proof construction is available.

6—Recorder is for low pressure ranges

For measuring and recording very low pressures, the Dickson Co. announces an exceptionally compact chart recorder. This instrument, the Type 3-B Minicorder, is designed for pressure

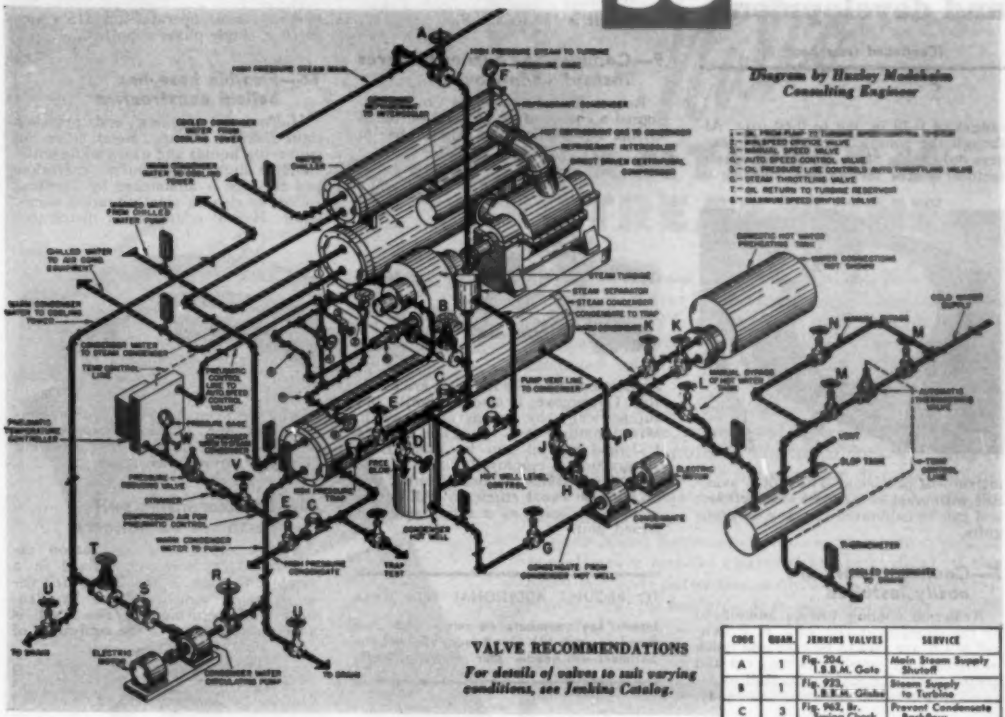
(Continued on page 10)

3—Hydraulic pump is also fluid motor



A 2000 psi vane-type, single stage oil hydraulic pump which can also be used as a fluid motor has been announced by The Denison Engineering Co. No alterations are necessary within the unit itself to utilize its two-way performance. Rotation in either direction is accomplished by a simple change in the position of the pumping cartridge. As a pump, capacities range from 2½ to 60 gpm. In fluid motor use, torque ranges from 12 to 257 in-lb per 100 psi.

JENKINS PRACTICAL PIPING LAYOUTS 58



VALVE RECOMMENDATIONS

For details of valves to suit varying conditions, see Jenkins Catalog.

CODE	QUAN.	JENKINS VALVES	SERVICE
A	1	Fig. 304, I.B.B.M. Gate	Main Steam Supply Shutoff
B	1	Fig. 952, I.B.E.M. Globe	Steam Supply to Turbine
C	3	Fig. 962, Br. Swing Check	Prevent Condensate Backflow
D	2	Fig. 970, Br. Globe	Free Blow and Trap Test
E	2	Fig. 280, Br. Gate	Trap Shutoff
F	1	Fig. 700, Br. Needle	High Pressure Steam Gage
G	1	Fig. 370, Br. Gate	Condensate Pump Shutdown
H	1	Fig. 92, Br. Swing Check	Prevent Condensate Backflow
J	1	Fig. 106-A, Br. Globe	Condensate Pump Control & Shutoff
K	2	Fig. 370, Br. Gate	Preheat Water Tank Shutoffs
L	1	Fig. 106-A, Br. Globe	Preheat Tank By Pass
M	2	Fig. 370, Br. Gate	Cold Water Shutoff Valves
N	1	Fig. 106-A, Br. Globe	Manual By Pass
P	1	Fig. 741-G, Br. Needle	Condensate Vent
R	1	Fig. 253, I.B.B.M. Gate	Condensate Water Shutoff
S	1	Fig. 339, I.B.B.M. Swing Check	Condenser Water Pump
T	1	Fig. 162, I.B.B.M. Globe	Condenser Water Flow Control
U	2	Fig. 106-A, Br. Globe	Drain Valves
V	1	Fig. 106-A, Br. Globe	Prevent Air Supply Shutoff
W	1	Fig. 741-G, Br. Needle	Pressure Gage Control

How to plan

CONNECTIONS FOR STEAM TURBINE DRIVEN CENTRIFUGAL REFRIGERATION COMPRESSOR

As shown in the diagram, steam from high pressure mains passes through an automatically controlled steam throttling valve which varies turbine speed in accordance with the load on the air conditioning system.

Control is based upon the temperature of the chilled water leaving water chiller. A pneumatic controller, positioned by a temperature element in the chilled water discharge pipe, controls air pressure on a diaphragm valve in the oil pressure system.

This valve controls the pressure on the steam throttling valve, changing speed of the turbine in accordance with air conditioning load. Exhaust steam from turbine enters the steam condenser which maintains a very low back pressure (26" to 28" vacuum).

Where district steam is used, it is generally uneconomical to return the condensate to the boilers; condensate is merely discharged to the sewer after some of the heat has been used to preheat domestic hot water for the building. Local codes specify maximum heat of discharge.

Jenkins Valves listed are rated for an assumed high steam pressure of about 160 psi. and the condensing water pressure of about 200 psi.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

TO SIMPLIFY PLANNING

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering, select all the valves you need from the Jenkins Catalog. It's your best assurance of lowest cost in the long run. Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal.

COMPLETE DESCRIPTION AND ENLARGED DIAGRAM OF THIS LAYOUT FREE ON REQUEST. Includes additional detailed information. Simply ask for Piping Layout No. 58.

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864
TRADE JENKINS MARK
Jenkins Bros.

New equipment and developments

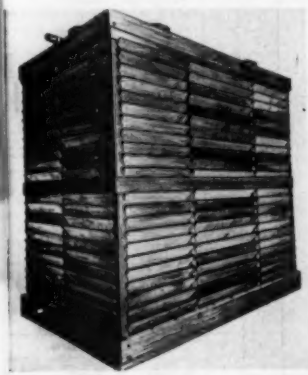
(Continued from page 8)

ranges of 0-10 in. wg to 0-60 psig. Although the complete instrument measures only 5¼ x 5¼ x 2¼ in., the manufacturer states there is no sacrifice in

instrument precision. The unit is available with brass or stainless steel bellows, and can be calibrated in many different units.

7—Cooling towers are easily installed

Redwood cooling towers announced by the Equipment Div. of J. F. Pritchard & Co. are said to be easy and quick to install. All parts are factory cut and drilled, requiring no special skill to assemble. The units, known as Cotospray,



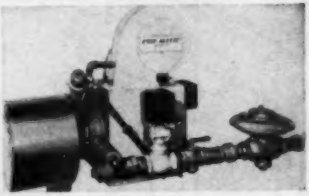
include distribution header and nonclogging bronze nozzle as well as such necessary accessories as float makeup valves, suction screen and overflow.

8—Improvements are added to industrial heaters

Edwin L. Wiegand Co. has announced improvements of two Chromalox industrial heaters. Standard design of the Type TBL electric tank heater now includes a vapor-tight terminal box for safety in corrosive and penetrating vapors. The Type ARMT screw-plug unit, with explosion-proof or vapor-tight terminal box, is available with wider built-in thermostatic range. For water heating the range is now 50 to 250 F. For oil heating it is 150 to 550 F.

9—Combination burner features instant changeover

Eclipse Fuel Engineering Co. has designed a combination gas and oil burner, the Fyr-Matic, for industrial use in



applications where both fuels are available. Changeover is made instantly and automatically by means of a switch. Mixed, natural or L-P gas and number 1, 2 or 3 fuel oil can be used. Dual atomization is employed, which is said to make possible the use of either gas or oil with equal efficiency. All equipment is included as a single self-contained unit.

TO REQUEST ADDITIONAL FREE DATA

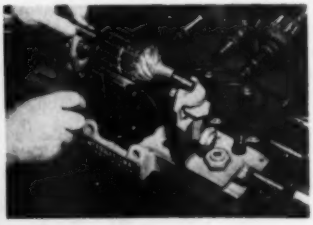
Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

10—Improved ballast has many advantages

A 440 v fluorescent lighting ballast developed by WAC Engineering Co. is said to offer many improved characteristics. It operates with a 45 per cent leading power factor. Less than one fourth the power loss of conventional ballasts is claimed. Lamps do not flicker with wide variation in line voltage. Starters are not required, and less shock in ignition extends lamp life.

11—Device detects shorted armature windings

International Products Manufacturing Co. announces the Short Finder, a device which enables quick and easy



detection and location of shorted windings in generator and starter armatures. No special training is required for operation. Average time for locating the shorted coils is said to be one minute. The unit, which is adjustable to accommodate any armature from 2¼ to 4 in. diam, operates on 115 v a-c, 50/60 c, single phase supply.

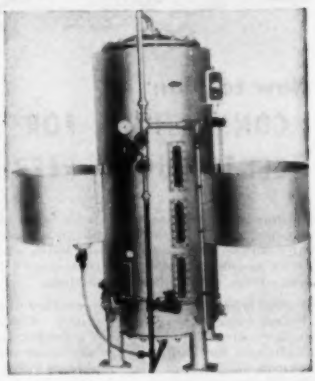
12—Flexible hose has helical construction

Uniflex, a seamless and pressure tight flexible bronze metal hose for conveying liquids and gases while withstanding high temperatures, corrosion and abrasion is announced by Titeflex, Inc. It is also an ideal vibration eliminator. Helical construction distributes

flexing between inner and outer convolutions. For additional safety, the hose is also produced with a covering of tensile bronze wire braid.

13—Demineralizing unit combines exchangers

Cation and strong base anion exchangers are intimately mixed in a single unit tank in the Mono-Bed demineralizing unit developed by Penfield Manufacturing Co. The result is a single unit which is the equivalent of



multiple bed systems. Uses are found wherever high purity, mineral-free water is required. Flow rates range from a few gallons per hour to over 5000 gph.

14—Selenium rectifier is corrosion proof

A completely air-sealed selenium rectifier unit is offered by Wesley Block & Co. The unit, manufactured by Richardson-Allen Corp., is cooled on the heat exchange principle. It may be safely installed near cleaning and pickling vats, in mines and in other corrosive atmospheres without danger to component parts.

(Continued on page 12)

1. PURE DISTILLED WATER has no dissolved solids; produces big steam bubbles that burst instantly at surface as shown in Nalco Laboratories test tube boiler.

2. BOILER WATER has high dissolved solids; small bubbles with foaming tendencies cause carryover and impure steam.

3. BOILER WATER WITH NALCO ANTIFOAM Treatment —same water as in Photo No. 2 —now produce large bubbles without foam and pure steam ...the same results as distilled water.

Photos in Nalco Laboratories — unretouched.

TH *Nalco* ANTIFOAM TREATMENT

NALCO Antifoam Chemicals, used as a part of Nalco System Water Treatment, consistently produce steam with only 1 to 3 parts per million solids content — and frequently permit more than double the dissolved solids in the boiler water without danger of carryover!

Truly dry steam is a welcome and valuable protection for turbines, pumps, and the entire steam system ...and Nalco Antifoam Treatment makes a simpler problem of control of boiler water dissolved solids, since it prevents carryover at concentrations far exceeding average practices.

Your Nalco Representative can show you copies of actual steam quality charts that are typical of the *before* and *after* performance of Nalco Antifoam Treatments — *but the best proof is in your own boilers* ... Call or write, today.

. . . and PRECISION-CONTROLLED BLOWDOWN

● Precision control of boiler blowdown is assured with the Nalco Meterblo Valve...Large, easy-to-read settings ... quick-opening and closing...can be mounted in 16 different positions without special fittings. Now available through your Nalco Representative . . . or write direct.

NATIONAL ALUMINATE CORPORATION
6218 West 66th Place • Chicago 38, Illinois
Canadian inquiries should be addressed to Alchem Limited Burlington, Ontario, Canada

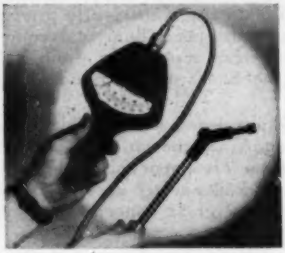
Nalco **STEM • Serving Industry through Practical Applied Science**

New equipment and developments

(Continued from page 10)

15—Hand pyrometer has two scale ranges

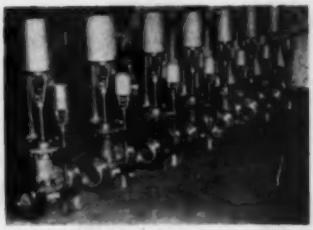
Hand pyrometer Type FH-1, announced by the Meter and Instrument Dept. of General Electric Co., employs two scale ranges, 0-500 and 0-1500 F. for rapid measurement of surface, liquid, gas and molten metal tempera-



tures. A switch quickly changes the range. Interchangeable tips include a surface tip, an immersion tip and a two-prong contact tip. An automatic compensation feature eliminates manual adjustment of the pointer for temperature variations of the instrument.

16—Control valves are for extreme conditions

Two control valves, Models 1570 and 1580, announced by Annin Co., handle a wide variety of materials at extremes of temperatures and pressure. Included are liquid nitrogen at -325 F up to 3000 psi, red fuming nitric acid at room temperatures and superheated steam to 1000 F. An external self-balancing arrangement provides balanced valve ef-



fect for ease of operation at extreme pressure differentials. Single seat split-body construction is employed. The relatively inexpensive lower half of the valve body can be easily replaced with minimum downtime.

TO REQUEST ADDITIONAL FREE DATA

Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

18—Unit reduces consumption of drying agent

Niagara Blower Co. is building an improved concentrator for the drying agent used in their controlled humidity method of air conditioning. This meth-

od uses a liquid drying agent to absorb moisture directly from air, thereby reducing humidity without refrigeration. The concentrator is said to reduce consumption of the liquid absorbent to a point where it is of no importance in practical operations. It can be applied to large air conditioning and drying systems involving high concentrations.

19—Level limit switches minimize false alarms

Level limit switches have been developed by Revere Corp. to minimize false alarms caused by vibrations or agitated solutions. Unusually compact and light-weight, the units employ a

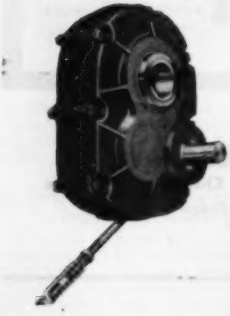
hermetically sealed, magnetically operated switch. The actuating magnet, incorporated in a counterweight, opens or closes an electrical circuit at a preset liquid level. Non-absorbent nylon is used for the float. The units can be used with fuels, water-alcohol mixtures and numerous chemical and processing liquids.

20—Aluminum welding rods offer high performance

Aluminum welding rods featuring an unusual degree of metallurgical cleanliness are being manufactured by All-State Welding Alloys Co., Inc. They are equally applicable for a-c or d-c welding including inert gas, or for oxy-acetylene welding. The rods are said to rate high in weldability and speed of application, producing uniform results and a smooth finish. Designated as All-State X-43S and X-2S, they are available in rod or coil form.

(Continued on page 16)

17—Shaft-mounted speed reducer has 43 hp capacity



Dodge Manufacturing Corp. has announced a double reduction shaft-mounted speed reducer with capacity to 43 hp. For output speeds from 12 to 110 rpm, this unit, the No. 7 Torque-Arm, has greater horsepower capacity than other models. It is mounted on the shaft to be driven. This shaft passes through the entire length of a sleeve. The reducer is held in place by two steel locking collars. A bushing keyed into the sleeve adapts it to the desired shaft size. A torque arm anchors the reducer and quick adjustment of belt tension is provided by a turnbuckle. Installation is simple and economical since foundations and flexible couplings are not required. The exacting job of lining up is also eliminated. The unit contains a double reduction train of helical steel gears. All shafts are supported by ball bearings of ample capacity. Gears and bearings are splash lubricated. When required to prevent reversal of the direction of rotation, a backstop can be easily installed within the unit. The right hand illustration depicts a typical application in which the unit is mounted on the shaft of a solid steel head-pulley of a sand belt. The anchoring arm is shown equipped with an overload release.

Conveyor Belting tailored to the job

For super-tension jobs involving heavier loads, longer centers, higher lifts—or for handling lighter materials on easier jobs—depend on NYB&P conveyor belts.

NYB&P, backed by more than a century of experience, has the skill and the facilities to produce belts of the most advanced design.

For any kind of mechanical rubber goods, call on your local NYB&P Distributor. Ask for his help in selecting from NYB&P's complete line . . . he knows what type of product is best for your needs. Contact him for your copy of NYB&P Conveyor Belt Manual.

NEW YORK BELTING & PACKING CO. NYB&P INDUSTRIAL RUBBER PRODUCTS Since 1846

NEW YORK BELTING & PACKING COMPANY

1 MARKET STREET, PASSAIC, NEW JERSEY

"STARTING LOAD ON OUR 40 H. P. CRUSHER MOTOR CAUSED 400 AMP. ORDINARY FUSES TO BLOW . . . BUT NOW 125 AMP. FUSETRON FUSES LET MOTOR START AND GIVE BURNOUT PROTECTION TOO."

Mr. Meeka explains . . .

"We have a crusher driven by a 40 h.p. 250 volt motor. The starting load on this motor is often quite heavy and gave us no end of trouble by causing the 400 ampere fuses protecting the circuit to blow.

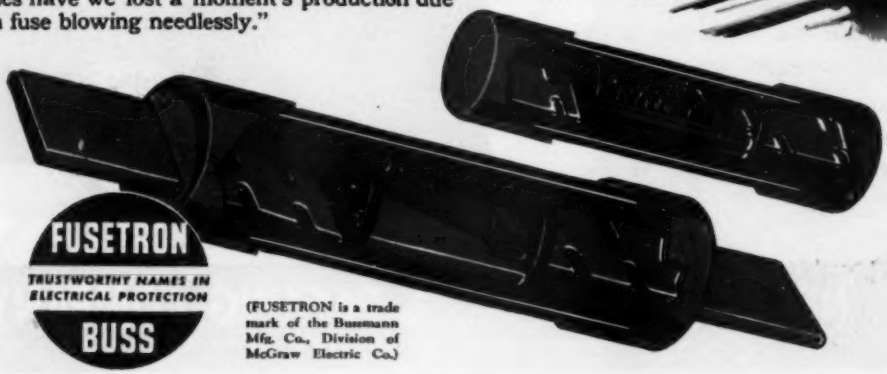
"Some months ago, after checking the actual running current of the motor with an ammeter, we decided to see if FUSETRON dual-element Fuses could live up to their claims.

"The ammeter reading indicated that 125 ampere FUSETRON Fuses should be used to give motor-running protection. So, we installed this size.

"Were we surprised—they not only hold the starting current of the crusher motor—but we have the satisfaction of knowing the motor also has burnout protection to back up the overload relays in case they should ever fail.

"Not once since we installed FUSETRON Fuses have we lost a moment's production due to a fuse blowing needlessly."

ED MEEKA
Supt., ROBINSON BRICK & TILE CO.
Denver, Colorado



FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

"FUSETRON FUSES NOT ONLY ELIMINATE USELESS SHUTDOWNS - THEY GIVE YOU 10 POINT PROTECTION."

1 Protect against short-circuits.*

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating—lesser resistance results in much cooler operation.

4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money — permit use of proper size switches and panels

10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December 1947.

DON'T RISK LOSSES

One **needless** shutdown . . .
One **lost** motor . . .
One **destroyed** switch or panel
One **burned out** solenoid . . .

May cost you far more than replacing every ordinary fuse with a Fusetron dual-element Fuse.

MAIL THE COUPON NOW for complete information about the All-Purpose Protection of FUSETRON Dual-Element FUSES.

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me complete facts about FUSETRON dual-element Fuses.

Name_____

Title_____

Company_____

Address_____

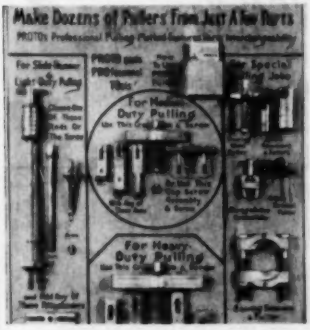
City & Zone_____ State_____ 552

New equipment and developments

(Continued from page 12)

21—Puller set includes storage rack

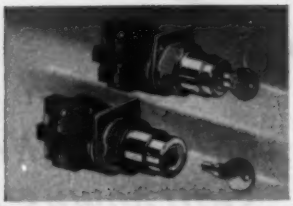
To eliminate stocking large numbers of special, assembled pullers, Plomb Tool Co. has developed a Proto master puller set. The No. SD6 Pullermart features interchangeable parts to meet



a wide variety of set-ups—for example, a crossarm and screw can be used with several different jaws to form completely different tools. Included with the set is a special storage rack designed to facilitate proper parts use. Top half of rack is shown.

22—Pushbuttons are key-operated

Key-operated cylinder locks for oil-tight pushbuttons are available from Westinghouse Electric Corp. Two basic types include a selector switch, having either 2 or 3 rotary positions, and a pushbutton type which can be de-



pressed in either full or intermediate positions. They are mounted in place of the standard operator on Class 15-022 Oil-Tite pushbuttons for panel mounting, or in surface mounting or flush mounting stations. Single or double pole contact blocks can be mounted in the bottom of the box or on the operator.

TO REQUEST ADDITIONAL FREE DATA

Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

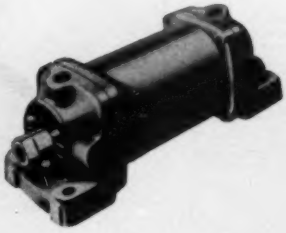
24—Continuous V-type packing is available

Continuous chevron-type packing for 500-6000 psi service is available from the Mechanical Packing Div. of Flex-

rock Co. Sizes in 1/16 in. increments from ¼ to 1 in. are available in 25 ft lengths. Known as Continuous-Vee packing, it is offered in two styles. No. 2005 for high temperature service features asbestos cloth and neoprene construction. No. 2008, for lower temperatures, uses cotton duck and neoprene.

25—Air cylinders offered in many styles

Air cylinders comprising 28 models, each with 9 in. bore diam, are offered by Rivett Lathe & Grinder, Inc. Keeper rings, used to hold covers together, permit rotation for convenient pipe locations. Self-adjusting packing is em-



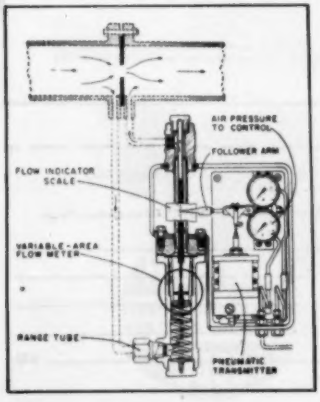
ployed, and pressure disposal on packing members is provided for. Recommended for pressures to 150 psi, the units are available in 7 mounting styles, in any length stroke to 96 in., single or double-end rods, with internal or external thread.

26—Fluorescent starter resets automatically

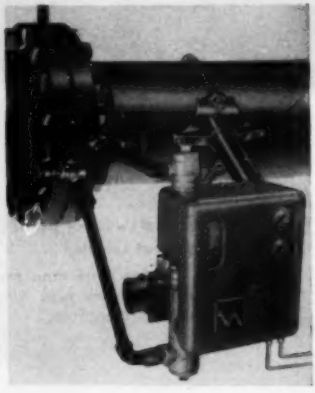
An automatic reset starter for 40 w fluorescent lamps, the FS4-NA Robot Cop, has been designed by the Lighting Div. of Sylvania Electric Products, Inc. to cut out a failed or flickering lamp. It provides automatic resetting when a new lamp is installed, and protects ballasts from overheating. Manual restarting, an expensive operation when large numbers of lamps have been cut out, is eliminated.

(Continued on page 20)

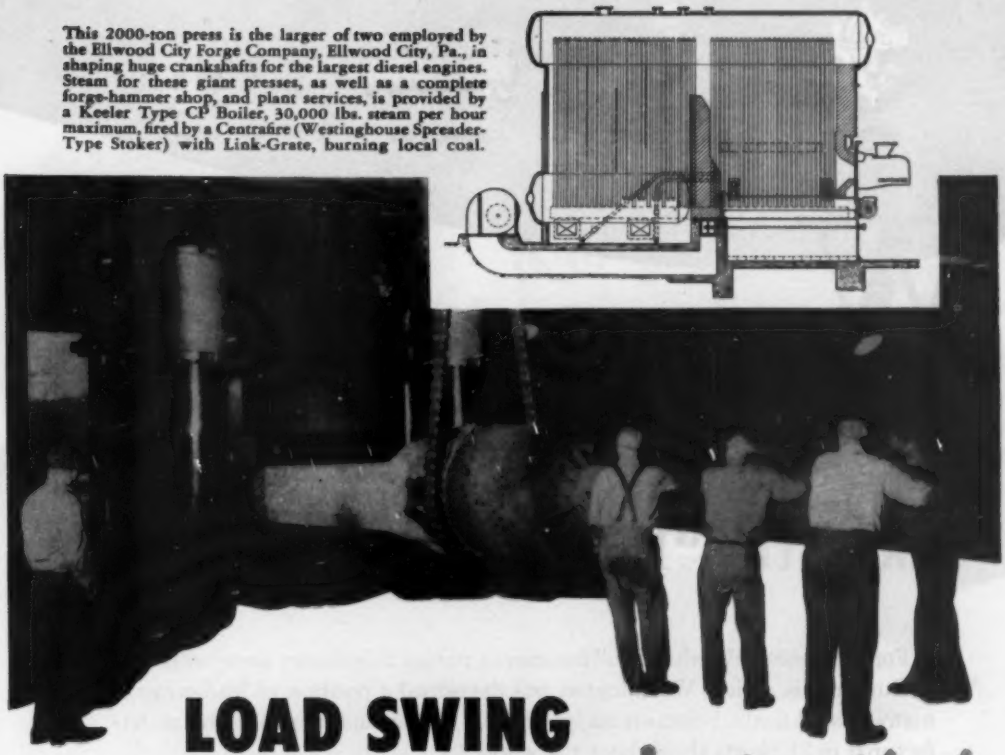
23—Instrument measures bypass flow rather than static head



Fischer & Porter Co. has developed an instrument, the V/A cell, which meters a continuous bypass stream around an orifice, instead of the conventional method of measuring static pressure differential across the orifice. Metering is therefore kinetic. In steam power water treatment and water supply fields, advantages claimed for the unit include: elimination of condensate pots in exposed locations; greater chart accuracy at low flows for more exact ratio control; good rangeability to handle variations of steam or water demands with the season or connected load; and simple central panel control through pneumatic linkage. The differential range can be varied from 50 to 1400 in. in standard increments, with a useable flow ratio of 10:1 at the 200 in. differential. Maximum operating temperature is 650 F. The cell case, measuring 9 x 11 x 7 in. is moisture and fume proof.



This 2000-ton press is the larger of two employed by the Ellwood City Forge Company, Ellwood City, Pa., in shaping huge crankshafts for the largest diesel engines. Steam for these giant presses, as well as a complete forge-hammer shop, and plant services, is provided by a Keeler Type CP Boiler, 30,000 lbs. steam per hour maximum, fired by a Centrafire (Westinghouse Spreader-Type Stoker) with Link-Grate, burning local coal.



LOAD SWING
from zero to 30,000 lbs. *instantly!*

As the giant presses and forge hammers at Ellwood City Forge Company are turned on and off, load upon the boiler . . . and the stoker . . . swings *instantly* from 10,000 to 30,000 lbs. . . . and back again, just as suddenly. In summer the swing is from zero to 30,000 lbs!

That's a grueling test of flexibility and dependability in the stoker, which must provide an instant inrush of heat to maintain pressure on the upswing . . . and must cut off cleanly to prevent boiler popping on the downswing.

Prior to installation of a Westinghouse Centrafire® with Link-Grate, the hammermen were starved for steam . . . were handicapped and slowed down in working the metal; costly reheats were often required. Boiler popping lost expensive steam to the atmosphere.

The Westinghouse Centrafire with Link-Grate, however, has ended these troubles. It follows the load . . . up or down . . . with a flexibility characteristic of the Centrafire. Moreover, with steam flow cut to zero for up to six hours between shift changes, the Centrafire holds the fire. And . . . there has been no forced shutdown of this unit since its installation.

You can have the flexibility . . . the reliability . . . the low operating and maintenance costs of a Westinghouse Stoker with any boiler of your choice. A Westinghouse Stoker Application Engineer is as near to you as your telephone . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-50529

YOU CAN BE SURE . . . IF IT'S
Westinghouse
STOKERS

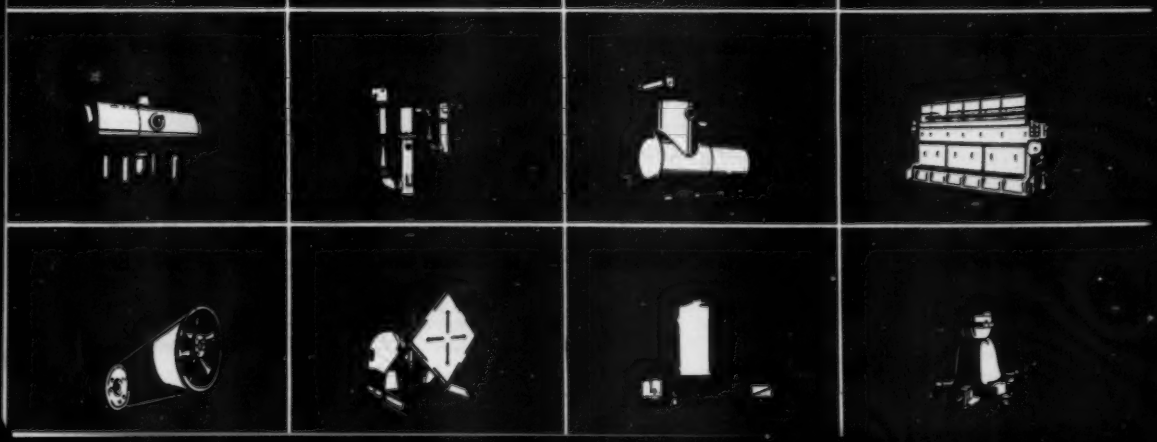
Why has the World's Leading Manufacturer of Pumps taken the "Pump" out of its name?

For 111 years "Worthington" has meant *pumps* to industry everywhere. During this period, Worthington has developed a position of leadership in many related fields. Fourteen major product lines including pumps are manufactured in 21 plants throughout the world.

To those we serve, Worthington is *more than pumps*. That's why the world's leading manufacturer of pumps has changed its name from

WORTHINGTON PUMP AND MACHINERY CORPORATION

22



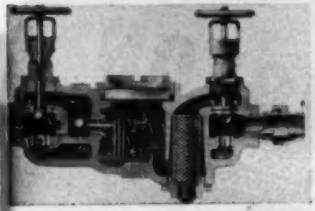
the World

New equipment and developments

(Continued from page 16)

27—Steam traps have integral bypass

Universal steam traps, Type S-BY and SA-BY, containing integral bypass, blowdown and shutoff valves, have been developed by Velan Engineering Co. The units are designed especially for processing industries where continuous uninterrupted operation is essential. Two valves incorporated in



the unit have a device to indicate valve position. The draining device can be completely closed, steam and condensate can be bypassed, all internal parts can be replaced, and condensate lines can be blown down with full steam pressure.

28—Instrument provides constant d-c source

Steady d-c source from an a-c line is provided by the Model 50220 Constant Current Supply, introduced by Weston Electrical Instrument Corp. Designed primarily for use with potentiometer indicators, recorders and controllers where automatic standardization or batteries are not feasible, it is also used

with instruments requiring constant d-c current, such as resistance thermometers and strain gages. The standard unit is for 10 ma output at 1.4 v, with current variation within 0.1 per cent. Supply current is 115 v, 60 cycle.

29—Plastic tubing has many uses

Production of thermosetting plastic and Fibreglas-reinforced tubing in commercial quantities has been achieved by Reflin Co. Such applications as fuel dispensing lines, standpipes, vent tubes, oil gathering lines, irrigation lines, salt water piping, electrical conduits and gas pipelines are listed for this lightweight, corrosion-resistant tubing. In addition to standard sizes of 4 to 10 in. OD, sizes to 36 in. are available to order. Bursting pressures range to 3000 psi.

30—Pyrometer controller provides close control

A direct reading indicating pyrometer controller incorporating a built-in unit to provide straight-line control is being offered by Wheelco Instruments Co. The unit, known as the Model 293 Capacitrol, automatically reduces on and off variation above and below the preset control point—thus a hair-line con-

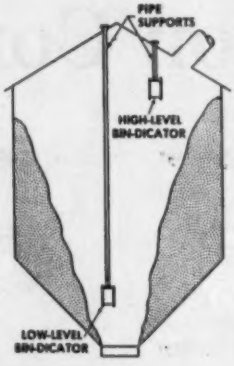
trol is achieved. Compact size is also featured. A wide range of standard scales in various thermocouple calibrations are available.

TO REQUEST ADDITIONAL FREE DATA

Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

31—Bin-level indicator is suspension mounted

The Bin-Dicator Co. has introduced a bin-level indicator to solve the problem of securing dependable level indication in large bins. The Model CS Bin-Dicator is designed for suspended installation, and can be located wherever



there will be free flow of material to and away from the diaphragm. This also permits application in bins containing materials which tend to build up on the side walls. The unit is designed for any size support pipe up to 2 in. diam. This pipe also accommodates electrical wiring. The unit can be easily moved to operate at different levels or lifted out for inspection.

32—Connecting devices lock in position

Current carrying connecting devices for prevention of accidental disconnects have been developed by The Arrow-

Hart & Hegeman Electric Co. The Hart-Lock assures a positive lock by a simple twist of the cap. Units available include 20 amp, 2-wire, 3-wire and 4-wire connector bodies; motor plugs; flush receptacles; and regular, rubber and armored caps with or without cord grips.

33—Upblast exhauster has low silhouette

An upblast power exhauster featuring a low silhouette has been developed by The Gallaher Co. The largest model,

rated 22,000 cfm, stands only 54 in. high. The lower height is said to reduce overturning effect. Totally enclosed type fan motor is used, and fan blades are coated for resistance to acid and alkali fumes.

34—Improved askarel has lower viscosity

General Electric Co. has developed an improved askarel for power transformers and load centers. Patented as 1470 Pyranol, it has a lower viscosity at lower temperatures and a lower pour point for easier handling under adverse weather conditions. Advantageous qualities of the earlier 1467 Pyranol have been retained, including non-inflammability. The improved askarel and the earlier product are completely miscible and can be used interchangeably.

(Continued on page 24)

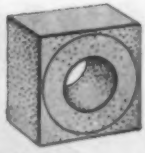
"Here's why I keep a stock of Kaocast on hand!"

The Chief Engineer of a mid-western power plant finds B&W Kaocast so *versatile* that he always keeps a ton or more on hand for miscellaneous jobs. This is only one of hundreds of plants in a list of diversified industries which are discovering practical, time-and-money-saving uses for this unique 3000 degree refractory castable. The panel at right gives a few examples.

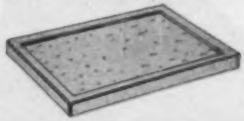
There are good reasons for these Kaocast "success stories". This jack-of-all-refractories can be molded in a hurry *by you, when you need it.* It can be cast directly in place or applied by cement gun. Kaocast not only makes possible faster repairs and eliminates the need for a large inventory of special shapes, but it also stays on the job. That's because Kaocast has high resistance to spalling and slag attack, low volume change and negligible re-heat shrinkage.

Get all the data on easy-to-use, versatile Kaocast from your B&W Field Engineer. His specialized experience is an important B&W "extra".

KAOCAST is another important refractories development by B&W engineers who have continuously established new standards in industrial furnace refractories for the past 30 years.

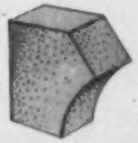


BURNER BLOCKS
Kaocast lasted 3 to 6 times as long as previous refractory. Still going strong.



DOOR LININGS
Kaocast lasted 3 to 6 times as long as previous refractory — cut installation cost in half.

TUNNEL KILN CAR TOPS
Ordinary fireclay crumbled after few trips. Kaocast lasted 30 trips without deterioration.



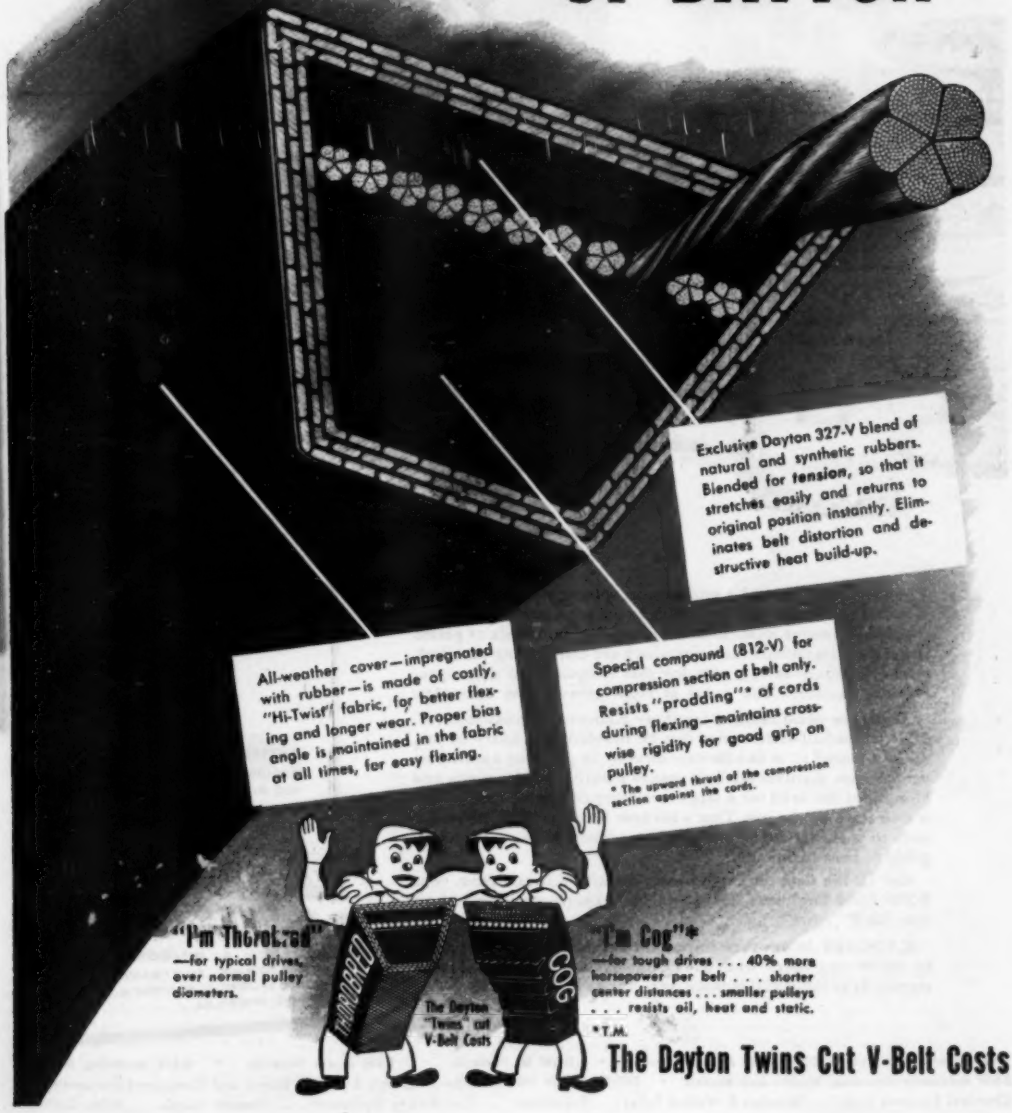
SPECIAL SHAPES
Kaocast special shapes cast over weekend to meet production demands.

BABCOCK & WILCOX
THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
WORKS: AUGUSTA, GA.

B-1407

B&W REFRACTORIES PRODUCTS — B&W Allmul Firebrick • B&W 80 Firebrick • B&W Junior Firebrick • B&W Insulating Firebrick B&W Refractory Castables, Plastics and Mortars • OTHER B&W PRODUCTS—Stationary & Marine Boilers and Component Equipment . . . Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers . . . Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings

HERE'S THE INSIDE OF DAYTON


Exclusive Dayton 327-V blend of natural and synthetic rubbers. Blended for tension, so that it stretches easily and returns to original position instantly. Eliminates belt distortion and destructive heat build-up.
All-weather cover—impregnated with rubber—is made of costly, "Hi-Twist" fabric, for better flexing and longer wear. Proper bias angle is maintained in the fabric at all times, for easy flexing.
Special compound (812-V) for compression section of belt only. Resists "prodding"* of cords during flexing—maintains crosswise rigidity for good grip on pulley.
* The upward thrust of the compression section against the cords.
"I'm Threaded"
—for typical drives, over normal pulley diameters.
"I'm Cog"*
—for tough drives . . . 40% more horsepower per belt . . . shorter center distances . . . smaller pulleys . . . resists oil, heat and static.
*T.M.
THREADED
COG
The Dayton "Twins" cut V-Belt Costs

The Dayton Twins Cut V-Belt Costs

STORY

V-BELTS' GREAT ENDURANCE!

The cords are the heart of any V-Belt—they carry the load. *Each* cord in a Thorobred Belt has thousands of continuous filaments, of high-tenacity rayon. Made exclusively for Dayton, these cords were developed after years of testing, to give high resistance to fatigue . . . extreme flexibility . . . great tensile strength!

Dayton—pioneer in the first successful method of chemically bonding rayon cords to rubber—now has a NEW *Thoro-Bond* method of coating *all* surfaces of each cord for better bond and longer cord life. In *Thoro-Bonding* the cord is untwisted just as it enters the dipping solution, then re-twisted. Ordinary dipping processes coat only the *outer* surfaces of the cord—*Thoro-Bonding* coats *all* surfaces of every strand in the cord.

AT WORK 12 YEARS . . .
. . .STILL GOING STRONG!

This Dayton V-Flat Drive has been hard at work for a dozen years, operating at a West Virginia coal mine. And what shape are the Dayton Belts in, after that much work—exposed to gritty coal dust? The mine superintendent reports they're good for another 3 to 5 years!

© D. R. 1952

For the complete Inside Story of the savings Dayton V-Belts can make for you, call your Dayton Distributor. You'll find his name under "Belting" in your telephone directory. He has a *complete* line of belts for *every* power need—and he has the answers to your drive problems! Dayton Rubber Company, Dayton 1, Ohio.

Dayton Rubber

Since 1905

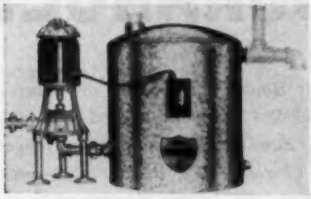
World's Largest Manufacturer of V-Belts

New equipment and developments

(Continued from page 20)

35—Condensate return unit features compact size

A condensation return unit for industrial plants requiring circulating hot water, air conditioning service or boiler feed is being manufactured by Advance



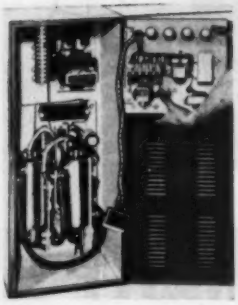
Pump Co. Called the Advance Heat-saver, it consists of a vertical, high-pressure centrifugal pump with ¼ hp motor and a 20 gal galvanized tank with float switch. Capacity is 2 to 33 gpm for discharge pressures from 4 to 60 psi. The unit is 25 in. wide, 35 in. long and 23 in. high.

36—Conveyer belt withstands high temperatures

Main Belting Co. has designed a canvas-asbestos conveyer belt, the ABC Hotstuff, for use with rapid drying operations, particularly where infra red or radiant heat ovens are employed. Heat range is over 600 F. The belt surface is not treated, so that weeping and also contamination of the product by offsetting are eliminated. Where the latter is not a problem, the belt can be obtained with an abrasion resistant material which may be recoated without removing the belt.

37—Electronic welder control is simplified

Square D Co. announces a simplified design of its electronic non-synchronous resistance welder control. Simplification provides easier installation, less



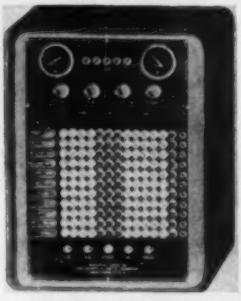
maintenance, smaller size and greater mounting versatility. The NEMA 3B weld and sequence timing circuit requires only 4 tubes plus valve relay and firing relay. Size, 15 x 15 x 37 in., and design permit either wall or side-of-machine mounting.

TO REQUEST ADDITIONAL FREE DATA

Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

39—Timing instrument provides flexibility

Independent adjustment of timing for each cycle of an industrial process is possible with the Cat. 125 Timed Operations Preselector, manufactured by



The Henry G. Dietz Co. Circuits in each cycle are automatically energized for preselected time sequences. A synchronous motor timer delivers repetitious impulses, any multiple of which can be preselected by means of push-buttons. Custom built units are assembled from stocked parts. Unit illustrated is used on laundry machinery.

40—Sleeves withstand wide temperature variations

Protective sleeves and boots for sliding and moving assemblies are offered by A & A Manufacturing Co. Material used for the Gortite-Sleeves is impervious to oil, grease and water and will withstand temperatures from -45 to 200 F. Protectors as large as 24 in. diam and 30 ft long are listed. Common uses in-

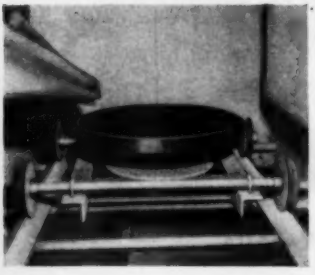
clude protection for piston rods, universal joints, hydraulic rams and lead screws. In addition to standard protectors, any number of specialized shapes are offered without mold charge.

41—Unit eliminates hard water scale

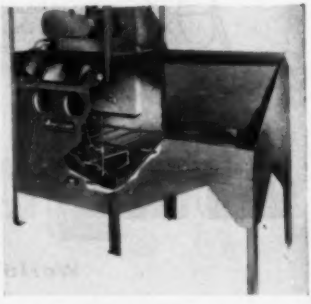
Heller Laboratories has announced a unit, the Hydrotron, which eliminates scale in heat exchange equipment by changing water electro-physically. Mineral content of either fresh or salt water crystallizes out in the form of sludge which can be removed by blowdown. The unit can be used to replace water softeners or chemicals for control of hard water scale in boilers, evaporators, condensers, bottle washers, hot water supply systems and air conditioning equipment. It is well adapted for once-through systems. Equipment consists of a bronze pipe unit, installed in supply line, and an electrical control unit. Anodes are not used.

(Continued on page 29)

38—Wet blast unit has pump for slurry recirculation



Liquamette, a wet abrasive blast machine manufactured by American Wheelabrator & Equipment Corp., uses a vertical-type centrifugal pump for slurry recirculation. The pump is not subject to plugging by abrasives, cannot leak slurry, does not require priming and can be easily removed for repairs. A method of hopper drainage eliminates handling of the slurry by the operator. The unit is used for cleaning of any precision-built work requiring close abrasion control, including reconditioning maintenance work. The work car and rotating table, shown at the left, are positioned for blasting.



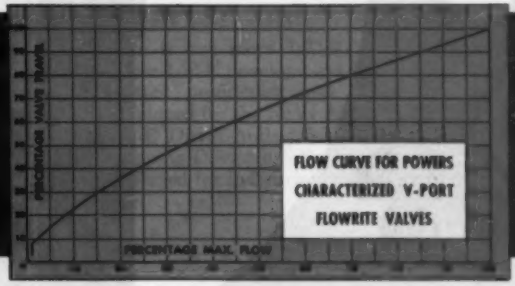
VALVE TOP—Durable molded neoprene diaphragm (1) has positive sealing bead which provides increased sealing action with increasing control pressure. Efficient diaphragm form insures ample and constant operating power thru full travel. Piston Plate Assembly (2) has a free floating thrust plate which absorbs side thrust. Closely guided piston plate maintains stem in accurate alignment. Maximum air pressure in top, 22 psi.

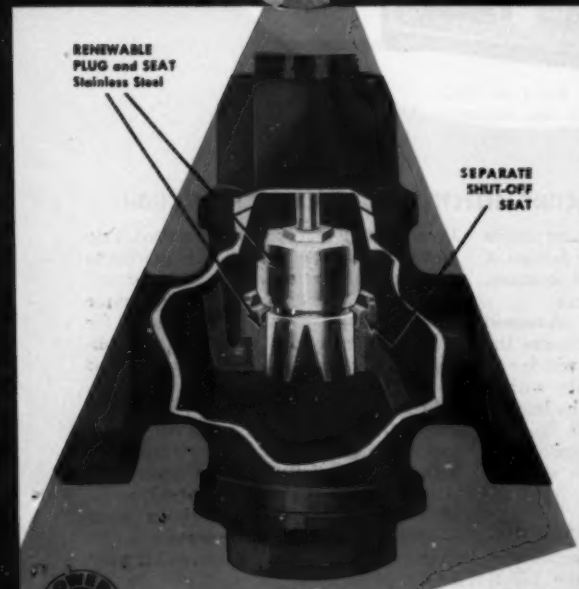
Special Cast Iron Housing and Top Only 4 Bolts
Compressed Air or Water Operated
BALL CHECK LUBRICATOR SILICONE grease for temperatures from 40° to 500° F.
Max. Pressure 250 psi.
Max. Temperature 450° F
SIZES: ½" thru 2
Direct and Reverse Acting

POWERS® SINGLE SEAT V-PORT *Characterized* FLOWRITE VALVES Give—

Special Flow Characteristics—High lift V-Port plug provides proportional flow throughout entire lift of stem as shown in chart below.

Wide Variety of Valve Sizes—Nine sizes are available, ½" thru 2". The ½" valve can be furnished with plugs to give 15%, 30%, 60% or 100% of maximum capacity. Plugs are easily interchangeable without removing valve from line.





Better Control—Less Maintenance—Superior design of stainless steel plug and seat reduces wire drawing, insures longer life and tight shut off. V-Ports do the throttling, protecting separate shut off seat. Plug and seat are truly removable and can be easily replaced in the field. Inner valves are machined and precision ground and lapped within very close tolerances.

Low Hysteresis—Due to smooth rolling diaphragm and polished stainless steel stem in preformed lubricated packing.

Easy to Adjust—Ball bearing adjusting screw; rust proofed steel calibrated springs with full travel in 5 or 10 psi.

Easy to Install—Powers Flowrite V-Port valves have double unions and bronze body with rugged construction to withstand piping strains.

Easy to Service—Valve and top are easy to take apart and re-assemble, facilitating inspection and maintenance.

Reasonably priced. Contact our nearest office for prices and assistance in selecting proper size valves

THE POWERS REGULATOR CO.

SKOKIE, ILLINOIS • Offices in Over 50 Cities

Chicago 13, Ill., 3619 N. Ashland Ave. • New York 17, N. Y., 231 E. 46th Street
Los Angeles 5, Cal., 1808 West 8th Street • Toronto, Ontario, 195 Spadina Ave.
Mexico, D. F., Apartado 62 Bis. • Honolulu 3, H. I., P. O. 2735—450 Piikoi at Kona

OVER 60 YEARS OF TEMPERATURE AND HUMIDITY CONTROL

(a79)

SERVICE CONTINUITY

ELIMINATES COSTLY PRODUCTION BREAKDOWNS

ISOLATES SYSTEM FAULTS

SAVES UP TO 63% ON INITIAL INVESTMENT

Direct-Acting Selective Overcurrent Trip Devices are available for I-T-E KA, KB, KC, and LG type circuit breakers in the following ratings:

15,000 to 100,000 amperes interrupting capacity

100 to 6000 amperes continuous

MODERN I-T-E DIRECT-ACTING SELECTIVE TRIP BREAKER PROTECTION

It's easy to protect production and profits against disastrous total power failure in complex electrical distribution systems. The cost is lower than you think.

Modern Selective Tripping—pioneered and developed by I-T-E—eliminates the failings of inadequate systems which can tie up an entire plant or utility with a single short somewhere along the line.

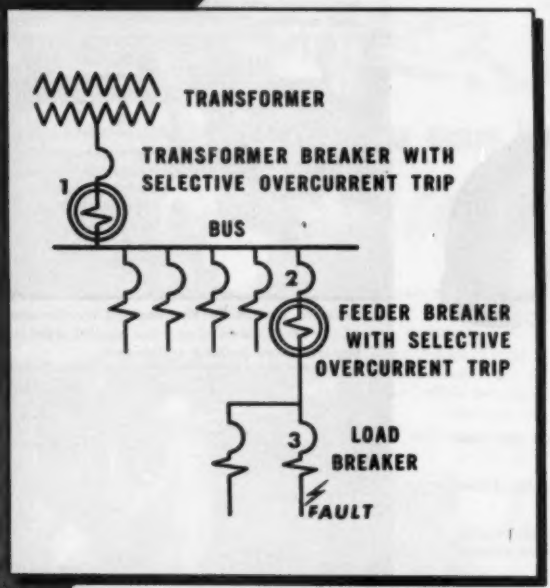
Selective Tripping limits the fault to *one* affected area only. Production continues—*uninterrupted*—throughout the rest of the system.

I-T-E TRIP DEVICE SAVES 63% ON INVESTMENT

Secret of this efficient delayed-action circuit breaker protection is the I-T-E *Direct-Acting* Selective Overcurrent Trip Device. Developed by I-T-E engineers to replace complex, expensive-transformer-relay auxiliary apparatus, this unique tripping device gives one more reason for I-T-E leadership in the design and application of quality circuit breakers and switchgear.

Positive—compact—dependable, the low-cost I-T-E Trip Device saves you up to 63% on accessory cost per circuit! And because it is a *direct-acting* device—an integral part of the circuit breaker—no additional space is required on your switchboard panel. Assure service continuity. Install I-T-E Selective Tripping in your plant.

COSTS LESS THAN YOU THINK



HOW SELECTIVE TRIPPING WORKS

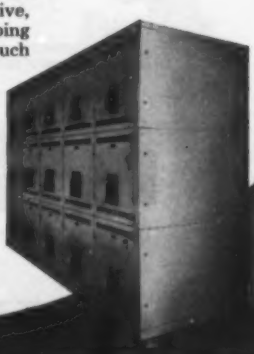
I-T-E circuit breakers, arranged in series, are *preset* to open in *definite sequence* (3, 2, 1 in diagram). If there is a sudden overcurrent or short circuit in any branch of the system, only the breaker (3) closest to the fault will open. Other breakers—other production machinery—in the system are unaffected.

ANOTHER I-T-E "FIRST"

Here is one more I-T-E "first"—another major I-T-E development to help industry protect production and save. Originally developed for the Navy during the War, the I-T-E Direct-Acting Selective Overcurrent Tripping Device has since been refined and perfected for industrial and utility use.

Call on I-T-E engineers—specialists in circuit breakers and switchgear—to see how positive, dependable I-T-E *Direct-Acting* Selective Tripping can protect your plant operation. See how much you can save.

For selection and application data on I-T-E large air circuit breakers, including selective tripping arrangements write for Catalog Section 1003 today. I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Phila. 30, Pa.

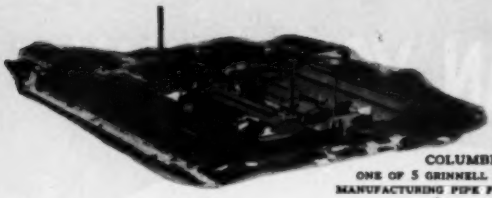


I-T-E

LOW-VOLTAGE SWITCHGEAR

I-T-E CIRCUIT BREAKER CO. • 19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

CANADIAN MFG. AND SALES: EASTERN POWER DEVICES, LTD., TORONTO • EXPORT SALES: PHILIPS EXPORT CORP., N. Y. 17, N. Y.



COLUMBIA, PA.
ONE OF 5 GRINNELL PLANTS
MANUFACTURING PIPE FITTINGS

GRINNELL

complete-line manufacturer of high quality PIPE FITTINGS

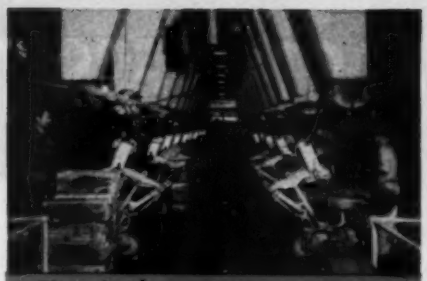
offers you...

- Complete line of high quality malleable iron and cast iron pipe fittings.
- Large stocks of pipe fittings — mass-produced by skilled workers using modern equipment.
- Dependability — the result of finest materials, equipment and methods; assured by rigid production control and triple inspection.
- Coast-to-coast network of branch warehouses and distributors — making available local stocks of Grinnell pipe fittings.

WHENEVER YOU ORDER PIPE FITTINGS,
CALL YOUR NEARBY GRINNELL WAREHOUSE OR DISTRIBUTOR

ONE OF 30 GRINNELL BRANCH WAREHOUSES

GRINNELL
WHENEVER PIPING IS INVOLVED



Dimensional accuracy assured by finest equipment and modern methods of mechanized molding.

Smooth inside finish obtained by the use of the best core sand and the employment of superior core making equipment.

Superior metal, poured into molds on continuous conveyors, gives Grinnell pipe fittings extra strength . . . extra ruggedness.

Accurate chamfer and precision threads, produced by modern tapping machines, pro-

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

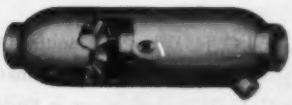
pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
Industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

New equipment and developments

(Continued from page 24)

42—Purifier is for small pipelines

Line type purifier, Type LC Hi-eF manufactured by V. D. Anderson Co., is designed for vertical or horizontal installations in pipelines from ½ to 2 in. diam. It provides efficient removal



of entrained liquids, solids, oil or dirt from steam, vapors or compressed air. A centrifugal element which imparts rapid rotational motion to the vapor throws out impurities. The units are unusually compact, the 2 in. size being only 5 in. diam and 17 in. long. Applications for steam up to 400 psi and 500 F are listed.

TO REQUEST ADDITIONAL FREE DATA

Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

43—Variable transformer is for low wattage

Designed for 50, 100 and 150 watt applications, the Powerstat Type 10 variable transformer manufactured by The Superior Electric Co. is said to be

the smallest unit of its type, both physically and electrically. It does not waste power in the form of heat—consequently is does not require ventilation. Input is rated 120 v, 60 c, single phase with output of 0-120/132 v, 1.25 amp, 150/165 va.

44—Generator produces oxygen without chemicals

Development of a semi-portable oxygen generator which will enable industrial users to produce their own oxygen for less than the cost of the purchased product has been announced by the Joy Manufacturing Co. This compact unit, measuring 8 x 7½ x 10 ft, uses no

(Continued on page 32)

you can lose plenty if you're

UNDER-TRAPPED

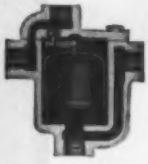
It doesn't pay to skimp on traps . . . especially steam traps. Water and air in steam lines reduces effective temperatures, wastes fuel and adds to maintenance costs.

Clark Steam Traps have proven their outstanding drainage efficiency over many years of use in thousands of plants. Now, with the new Duo-Step double-drainage capacity feature, they can handle twice the condensate of ordinary traps.

It will pay you to see your Clark representative or write us for further information.

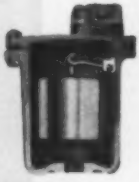
QUICK CLEANING STRAINERS. Remove dirt, scale and grit from steam, fluid and gas lines. Sizes ½" to 3" I.P.S.

SERIES "60" INVERTED BUCKET TRAP. Choice of horizontal or vertical inlet or outlet. For pressures up to 150 P.S.I. "Clark-lay" guided disc and seat.



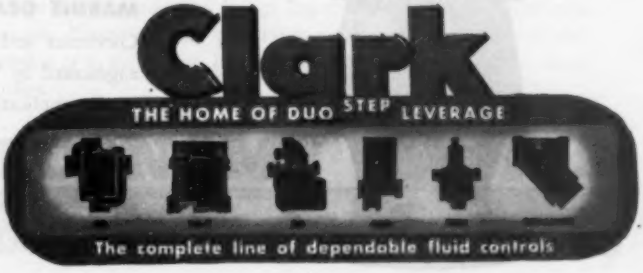
CLARK "701" - D (DUO-STEP) TRAP. A forged steel trap for pressures up to 500 P.S.I. and temperatures of 750°F. Equipped with "double-drainage" Duo-Step leverage and venting, Clark-lay seats and discs. Pipe sizes ½" or ¾".

SERIES "80"-D (DUO-STEP) TRAPS. Cast semi-steel construction for pressures up to 250 P.S.I. and temperatures to 450°F. Equipped with Duo-Step Leverage and Venting, Clark-lay seats and discs. Pipe sizes from ½" to 2".

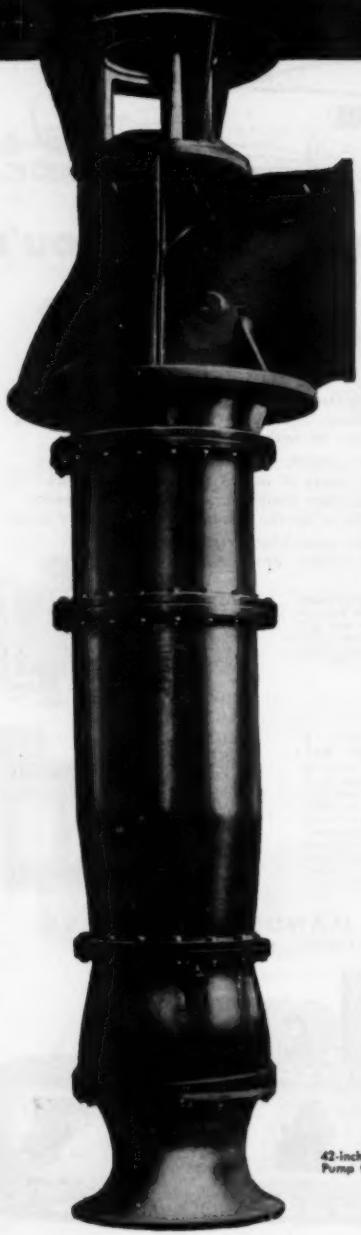


THE CLARK MANUFACTURING CO.

1830 EAST 38th STREET • CLEVELAND 14, OHIO



C. H. WHEELER & *CONSOLIDATE TO*



42-inch Wheeler-Economy Vertical Mixed Flow Pump for condenser circulation. 32,500 G.P.M.

Economy Pumps, Inc. and C. H. Wheeler Manufacturing Company have consolidated engineering and manufacturing facilities in C. H. Wheeler's plant at Philadelphia. Facilities are now being expanded through new construction and the installation of additional modern machine tool equipment.

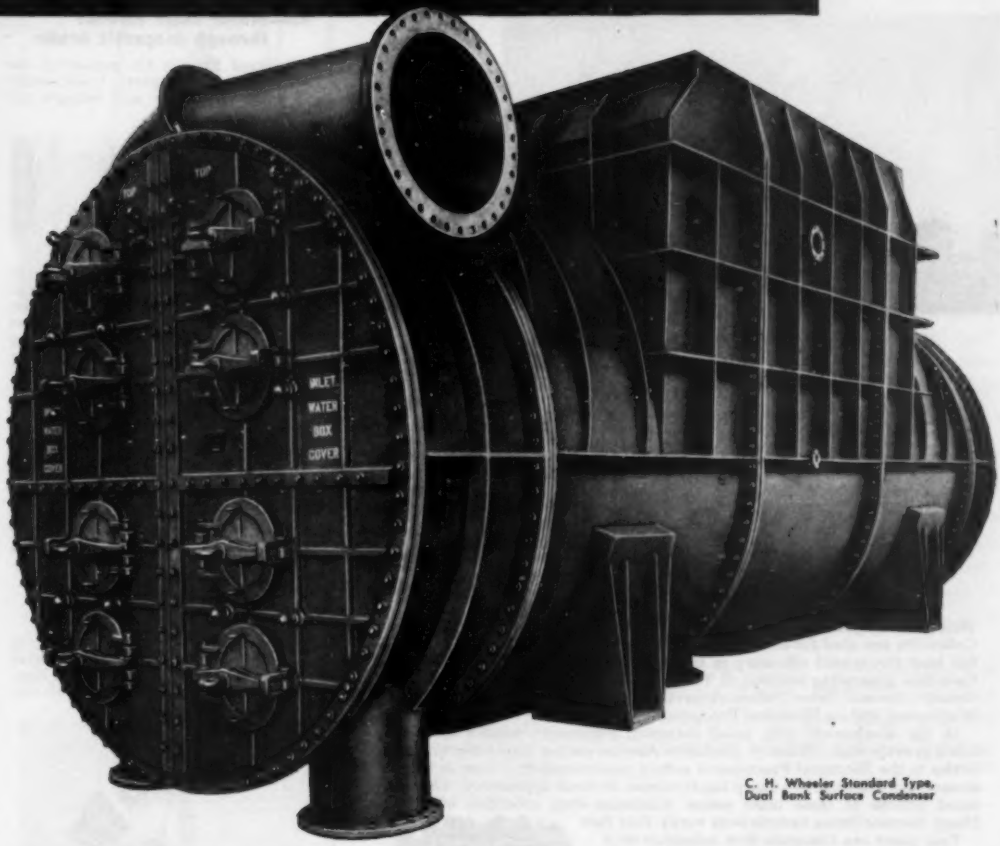
PUMPS . . . Economy has for many years been among the leaders in the engineering and manufacture of centrifugal, axial and mixed flow pumps. Today, the Wheeler-Economy line is one of the most modern and complete in the pumping industry.

CONDENSERS & POWER PLANT EQUIPMENT . . . The C. H. Wheeler Manufacturing Company has contributed many of the outstanding developments in the field of condensing apparatus and vacuum problems. Nearly a decade ago, C. H. Wheeler adopted Economy mixed flow pumps for use with their condensers.

PROCESS EQUIPMENT . . . C. H. Wheeler is also internationally known for Cooling Towers, Steam Jet vacuum apparatus and Fine Particle Reduction Mills, vital links in modern chemical and food processes. Wheeler-Economy Pumps will round out the company's services in these fields.

MARINE GEAR . . . C. H. Wheeler's Marine Gear, Condenser and Deck Machinery department will be augmented by Wheeler-Economy Pumps designed for marine application.

ECONOMY PUMPS, Inc.
SERVE YOU BETTER . . .



C. H. Wheeler Standard Type, Dual Bank Surface Condenser

WHEELER-ECONOMY PUMPS

. . . a new name combining old names that have been known and respected for generations. All the experience and metal working techniques this consolidation brings together are of great importance to you — our customer. Wheeler-Economy Pumps will fill your every requirement regardless of size or problem involved. Write to Philadelphia or to the nearest Economy or Wheeler representative listed in the phone directories of principal cities.

113-B

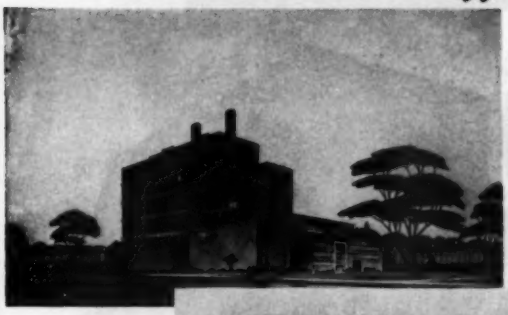
WHEELER-ECONOMY PUMPS

ECONOMY PUMPS, INC. • DIVISION OF C. H. WHEELER MANUFACTURING CO.
19TH AND LEHIGH PHILADELPHIA 32 PA

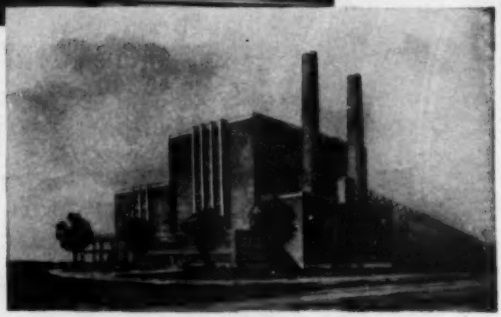
ON THESE TWO INSTALLATIONS

the AEROTEC SERIES

Assures 97.5% FLY ASH COLLECTION *Efficiency*



LEFT: The 264,000 kw (four units) J. Clark Keith Generating Station of The Hydro-Electric Power Commission of Ontario at Windsor, Canada. H. G. Acres & Co., Niagara Falls, Ontario, Consulting Engineers.

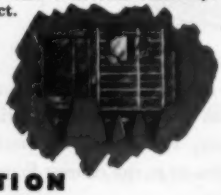


RIGHT: The 400,000 kw (four units) Richard L. Hearn Generating Station of The Hydro-Electric Power Commission of Ontario at Toronto, Canada. Stone & Webster Engineering Corp., Boston, Mass., Engineers and Constructors.

Here's on-the-job proof that Aerotec Series Mechanical-Electrical Dust Collectors are used for continuous efficiency. Guaranteed 97.5%, at normal full load the overall efficiency is anticipated as high as 99% at these two Canadian generating stations of The Hydro-Electric Power Commission of Ontario. Aerotec Series Collectors serving each plant combine a design 3RAS Mechanical and an Electrical Precipitator.

In the Mechanical unit, small diameter, permanent molded aluminum tubes provide high efficiency. Exclusive Aerotec pocket type collecting electrodes in the Electrical Precipitator reduce reentrainment of dust in the gas stream, contributing to a sharp improvement in stack appearance. The combined actions of these units assure maximum dust collection efficiency. Many Aerotec Series installations verify that fact.

Your plant can eliminate dust nuisances with Aerotec equipment just as many well-known companies have done. This highly successful performance is a reliable measure of Aerotec ability to solve your dust collection problems. Write our Project Engineers today!



Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONNECTICUT

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THE AEROTEC CORPORATION

GREENWICH, CONN.

New equipment and developments

(Continued from page 29)

chemicals. Only air and power are consumed. Purity of oxygen is 99.5 per cent. Heart of the unit is a series of automatic reversing heat exchangers.

45—Motor shaft extends through magnetic brake

Reuland Electric Co. announces development of a magnetic brake design in which all levers and linkages are

eliminated. A direct automatic set and release action between the solenoid and armature is featured. The design permits the motor's output shaft to extend completely through the brake. Lining wear is automatically compensated for by spring action. Ratings are 3, 10 or 25 ft-lb continuous duty, and 15 or 35 ft-lb for intermittent duty types.

TO REQUEST ADDITIONAL FREE DATA

Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

46—Lever jack has aluminum housing

Aluminum housing is used for the Simplex A1022 ratchet lowering lever jack manufactured by Templeton, Kenly & Co. Although capacity is 10 ton,

the unit weighs only 42 lb. Lift is 12 in., with a minimum height of 20½ in. A broad toe lift with 2 in. minimum height lifts full rated capacity of the jack.

—End

A gearturbine built to save...

Three ways

The Westinghouse Gearturbine costs less to buy . . . less to install . . . and less to maintain. Wrapped up in a single package is a compact, rugged and reliable speed-reduction unit solidly coupled to a Type E turbine. It's the ideal combination for ratings up to 500 hp and output speeds commonly found in single-ended applications.

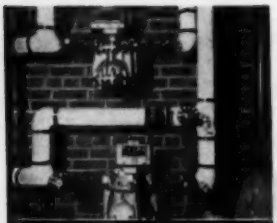
Here's economy made possible by a standardized design that cuts manufacturing costs . . . avoids costly specials . . . saves space . . . and simplifies maintenance. And you get the maximum flexibility possible . . . any combination of three turbine wheel sizes, three gears and three types of governor can be used according to your needs.

Other plus features are . . . solid coupling of turbine shaft to pinion shaft; single-helical gearing; forced circulation, filtered oil; and 3-point support for easy mounting and leveling.

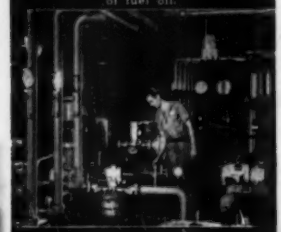
J-50521

GET THE FULL STORY. A newly available booklet, B-4346, clearly explains the applications, refinements and advantages of Westinghouse Gearturbines. Ask your nearby Westinghouse representative for your copy, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

YOU CAN BE SURE... IF IT'S
Westinghouse
TYPE E Turbines

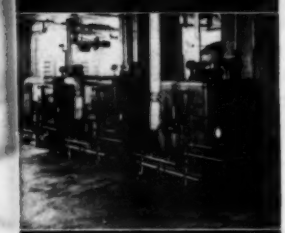


FUEL OIL MEASUREMENT
XACTO METER for accurate control in transfer and storage of fuel oil.



LIQUID BLENDING
BLENDERS for the continuous blending of 2 or MORE liquids.

METALWORKING
FILTERS for continuous coolant filtration systems.



POWER GENERATING
OIL CONDITIONER keeps turbine bearing oil clean — minimizes costly failures.

POWER EQUIPMENT
HYDRO VOLIFIER portable oil conditioning unit for transformers, circuit breakers and switch gears.

BOWSER
ESTABLISHED 1885

Specialists in . . .

LUBRICATION
FILTRATION
OIL STORAGE
METERING
for industry!

Bowser lubrication and liquid control systems are known for dependability in every type of industrial plant. Operating men have learned to rely on Bowser equipment . . . they know it minimizes downtime . . . lowers maintenance costs — stays on the job day-in-and-day-out.

Installations of Bowser equipment range from individual units to complete systems that serve entire plant facilities.

Bowser can furnish complete engineering service and can supply all the necessary equipment for proper installations. You are assured of complete satisfaction, too, because Bowser will assume the entire responsibility of efficient operation.

Bowser men have "know-how" in the handling of liquids. Consult NOW with the BOWSER man in your territory — there's no obligation!

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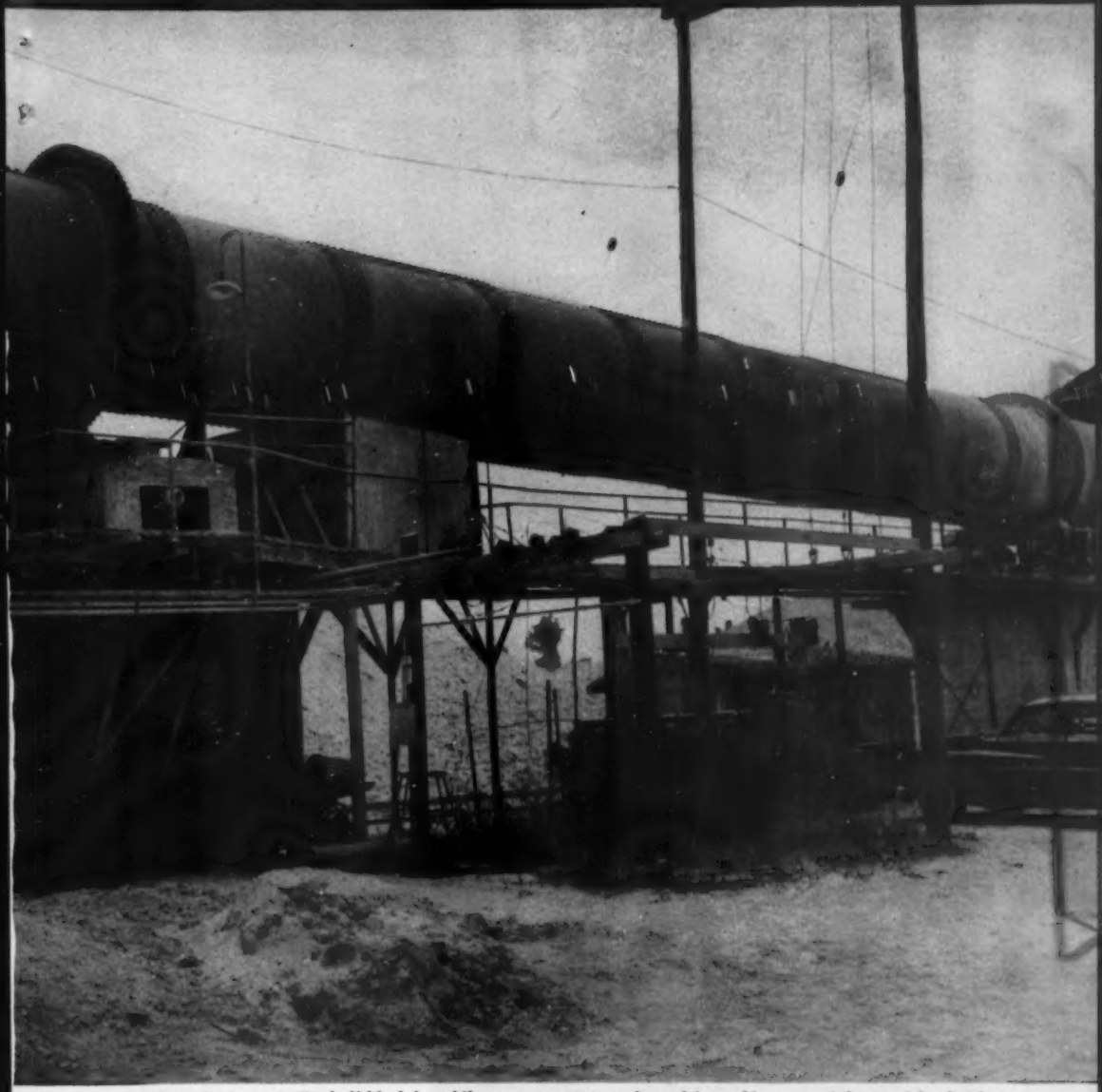
B.F.Goodrich GROMMET BELTS AT WORK



Giant "mix master"—half block long kiln processes compounds used in making a special type of fire brick.

Oven half a block long

That big cylinder in the picture above is a kiln used in making fire brick. It must be kept turning 24 hours a day. Keeping it turning was once a major problem. The V belts which drove it couldn't take the terrific punishment from the natural enemies of rubber—heat and oil and grease. A new kind of belt was needed. To see how the problem was solved, read the following pages.

Oven half a block long (continued)

V belts are "boiled in oil"—spattered 24 hours a day by hot grease from gears on heated kiln.

The ordinary V belts previously used couldn't withstand the heat, oil, grease and constant exposure to weather, as described on the preceding page. So B. F. Goodrich grommet belts were installed on trial—and since, have been running almost continuously; 24 hours a day for over a year. This is just one more example of how special compounding of rubber and the husky grommets in B. F. Goodrich V belts give a plus in service, lower operating cost and trouble-free operation!

20 to 50% Longer Life

Patented grommet V belts by B. F. Goodrich represent the only basic improvement since invention of the V

belt. Belts last 20 to 50% longer, depending on service. (The more severe the service the greater the increase over ordinary belts.)

What is a Grommet?

A grommet is like a giant cable except that it's endless—a cord loop built up by winding heavy cord on itself. There is no overlapping cord *section* as in all ordinary belts. Most belt failures occur in these sections where cords overlap!

All Cords Put to Work

Each grommet and every part of a grommet carries its share of the load. In ordinary belts under high tension the center cords "dish" because tension is greater near the driving faces. Dished cords are doing less work, not pulling their share. Grommet V belts have no center cords, there is no dishing—therefore much more strength in proportion to cord volume.

Better Grip, Less Slip

Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip pulleys better. Size for size, grommet belts give ⅓ more gripping power, pull heavier loads with a higher safety factor. Because there is less slip there is also less surface wear.

They Cost No More

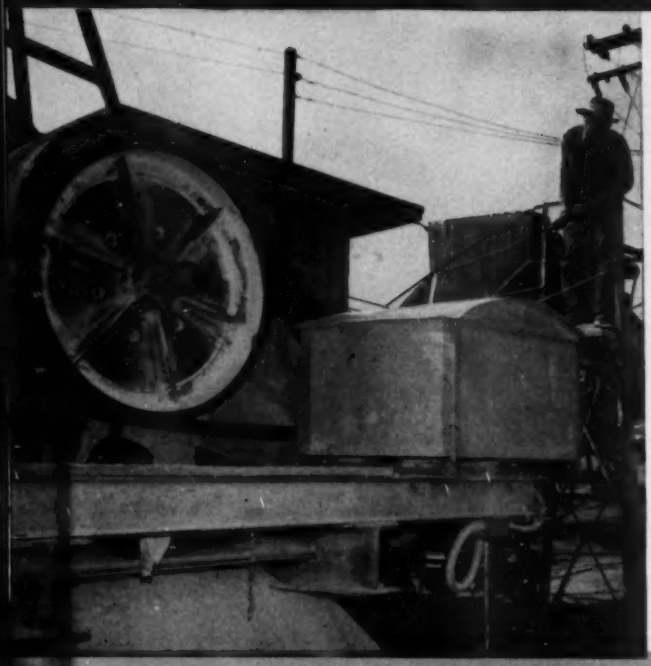
You save belt costs because belts last longer, save production costs because machines keep running with fewer interruptions, save maintenance costs because they need less attention, yet cost not one cent more than others. Grommet belts are made in C, D and E sections. They are patented by B. F. Goodrich. No other V belt is a grommet belt (U. S. Patent No. 2,233,294).

Wanted: Reliability

These belts help operate a paperboard machine at Austell Box Board Corp., Austell, Ga. This equipment runs 24 hours a day. Steel cable belts formerly used were unreliable in the face of the severe shock loads typical with this type of machinery. A distributor recommended B. F. Goodrich grommet V belts. And these have run trouble-free; have given between 3 and 4 times more service than previous steel cable V belts. The mill now runs without any interruption from belt troubles and the plant engineer credits grommet V belts.

Grommet V belts replace steel cable belt—give 3 times the service.

B.F.Goodrich GROMMET BELTS AT WORK



9 years' work in 4

Sierra Rock Products Co., Monrovia, California works double and triple shifts. That's how they figure that these B. F. Goodrich grommet belts gave 9 years' service in 4 years. And this record is even more spectacular when you consider these belts had to withstand the jolting strain of the primary rock crusher they drove, and had no shelter from the hot sun or abrasive action of sand and grit.

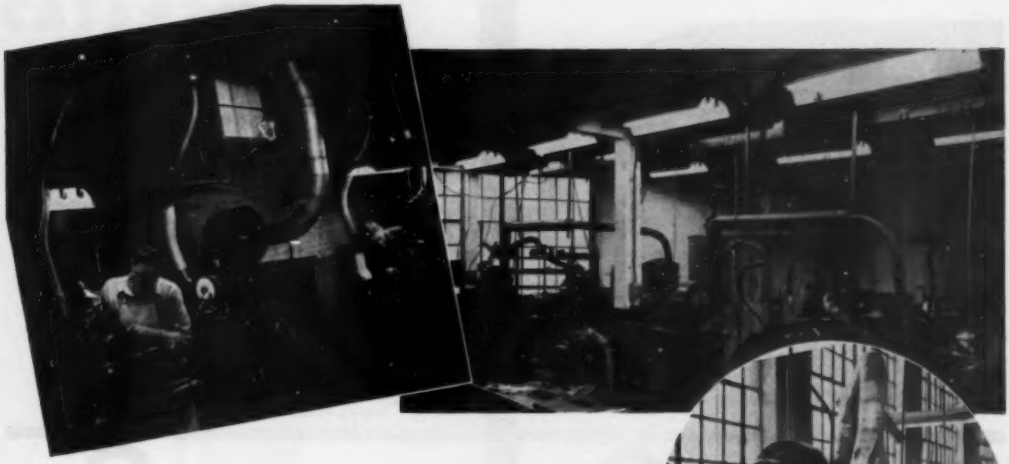
The grommet V belt is a typical B. F. Goodrich improvement—a money-saver that does jobs better in industries of all kinds. Good reasons why it will pay you to get in touch with your BFG distributor when you need V belts.

Another outstanding grommet V belt performance record.

These typical examples (see preceding pages) tell you why B. F. Goodrich grommet belts are superior to ordinary V belts—prove they last 20 to 50% longer—yet cost no more.

Grommet V Belts BY
B.F.Goodrich
FIRST IN RUBBER

The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio



Protect work and workers— control dust with

Norblo

high efficiency portable bag type *Dust Collection Units*

Any dust creating process, however small or intermittent, should be controlled if you want to avoid conditions that impair efficiency and endanger the health and safety of employees. Many plants can be effectively equipped with Norblo Portable and Semi-Portable Dust Collection Units *selected to fit the need.* They give you localized dust control for grinding, polishing, sawing and other operations at much lower cost than is possible with a large centralized system. Moving these units is no chore when plant rearrangement is necessary.

These Norblo bag type *portable* units occupy small space (maximum 4′ x 2′ floor plan); can be elevated to save floor area. Six sizes, covering a range of 300 to 1350 C.F.M., all operate at 8″ static pressure at the fan, complying with all industrial codes. Units are available in three arrangements for dust clean out—through door, hopper or drawer . . . Norblo *Semi-Portable* units are used where required capacities are greater than 1350 C.F.M. but less than that of usual large scale installations.

Norblo units are unusually quiet—are sturdily built for long service and low upkeep. Write for Bulletin 163-5.

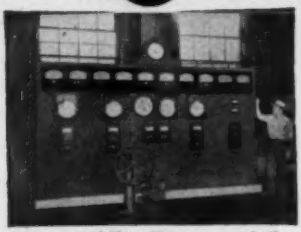
THE NORTHERN BLOWER COMPANY

Engineered Dust Collection Systems for All Industries

6422 BARBERTON AVE. • CLEVELAND 2, OHIO

5 ways to use HAYS low pressure gages

1



Pressure and Flow Measurement in Gas Producer Plant. In this automatically controlled gas producing plant Hays FOT indicators show gas header pressure, stack pressure, air pressure, and air flow. The FOT is a popular pressure-flow instrument in the process industries.

2

Resistance Measurement in Air Conditioning Systems. The Hays air filter gage is a money-saver when used to indicate the amount of resistance through filters in air circulating systems. When equipped with open or closed switches it flashes or sounds an alarm when resistance becomes excessive.

3

Commercial Boiler Testing Portable easily handled Hays "B" gages are widely used for checking draft in the combustion chambers of small automatically fired boilers to assure maximum efficiency. The scales are easily read—large black figures on a light background. Gages are compact, rugged.

4

Product Testing by Differential Pressure Measurement. Here the simplicity of the Hays FOT indicator makes possible testing of a complicated product by unskilled workers. Hays gages were selected because of their accuracy and because they could be supplied with large, easily read scales.

5

Continuous Draft Indication in Boiler Furnaces. Banks of Hays "V" gages are a familiar sight in thousands of boiler rooms. They provide an accurate "picture" of furnace draft conditions at any given moment and thus warn the operator of soot deposits, slag accumulations, too thin a fire, burned out baffling, etc.

HAYS has the most complete line of low pressure gages on the market.

● 4 diaphragm units available for both pressure and differential ● diaphragms of colon leather or of synthetic impregnated material highly resistant to corrosive atmospheres, moisture and oxidation ● 4 case sizes ● as many as 12 pointers in one case ● ranges from a minimum of .2" water to a maximum of 120" water ● for indicating, recording, or controlling draft pressure, differential or flow ● wall, lug, or flush mounting—also portable models ● interior or exterior illumination ● square root extractors available.

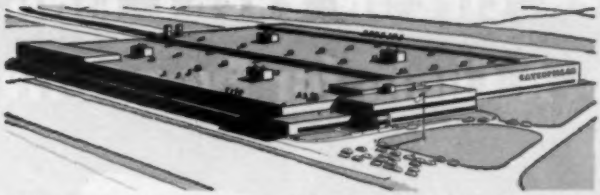
What's your draft or pressure problem?

Hays engineers are anxious to help you solve your low pressure measurement and gas or air flow problems. They have applied Hays gages to situations ranging from the determination of fuel oil level in marine vessels to the measurement of the density of mud in oil drilling operations. Send a description of your problem to Clarence Miller, The Hays Corporation, Michigan City, Indiana. You'll receive Hays' recommendations plus Bulletin 49-667 describing the complete line of low pressure instruments.

THE HAYS CORPORATION
MICHIGAN CITY 2, INDIANA

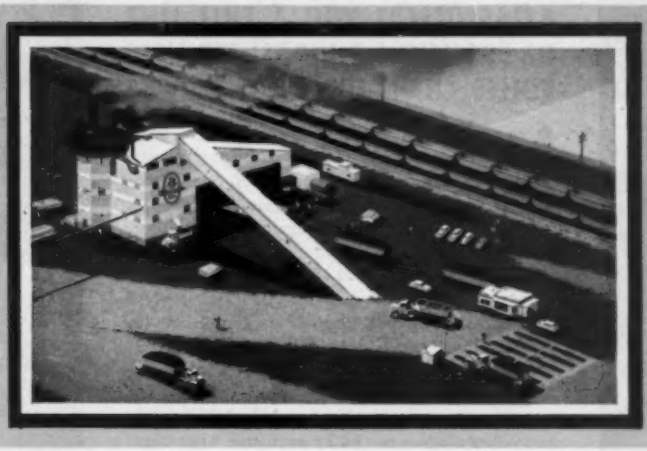
Automatic Combustion Control • Boiler Panels • Hays-Penn Flowmeters
Varifow Meters and Veritrol • Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders • Electronic Oxygen Recorders

CATERPILLAR



Caterpillar Tractor Co.'s modern new plant in Joliet, Illinois

By being constantly alert to practical ideas that improve production efficiency and lower costs, Caterpillar maintains a world wide prestige and satisfies the steadily increasing demand for earth-moving products of unquestionable quality.



Modern Wilmington Mine in northern Illinois, typical of Southern's extensive coal operations.

SOUTHERN'S CO-ORDINATED COAL SERVICE LOWERS FUEL COSTS AND INCREASES BOILER EFFICIENCY FOR CATERPILLAR

Caterpillar, like many other leading national industries has proved that economical steam production is afforded by the four basic fuel advantages provided by Southern: *Widely Diversified Coal Selection; Dependable Supply; Uniform High Quality; Application of the Right Coal to Specific Burning Equipment.*

SOUTHERN'S efficiently operated modern mines, advantageously located in Illinois, Western Kentucky, Indiana, Ohio have annual capacity of 10,000,000 tons; tremendous reserves.

SOUTHERN'S coals are engineered to strict industrial specifications. They are washed, rinsed, precision sized and blended in the nation's most modern preparation plants. Uniform high quality is rigidly controlled by laboratory tests daily at the mines.

Application of the right coal to your specific requirements is factually proved by equipment analysis and burning tests in your own boilers.

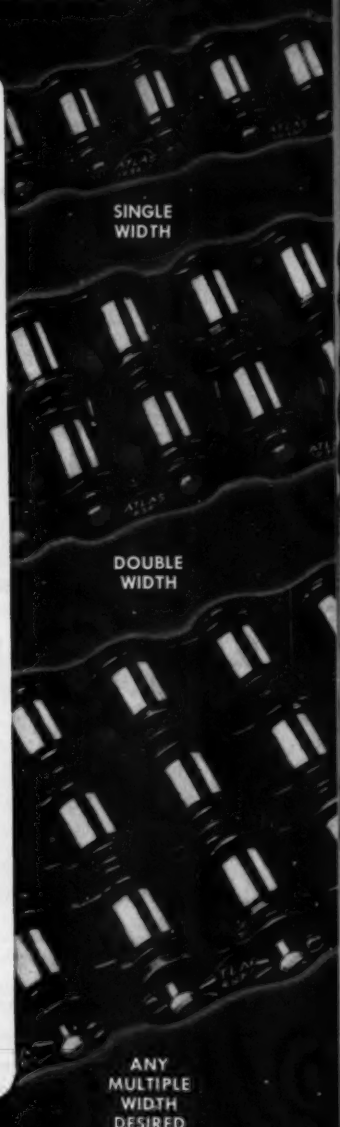
You also may effect fuel savings through this well co-ordinated Industrial Coal Service. Your nearest Southern office will gladly furnish specific recommendations and proposals.

YOU CAN RELY ON SOUTHERN'S ENGINEERED INDUSTRIAL COALS

Southern Coal Company, Inc.

GENERAL OFFICE: 333 North Michigan Avenue, Chicago 1, Illinois
OFFICES IN: Louisville, Memphis, Nashville, St. Louis
Sinclair Coal Company, Kansas City, Mo., Western Representative

LONGER LIFE IN EVERY LINK
...A Chain for Every Drive!



ATLAS OFFERS YOU A FULL LINE OF PRECISION-BUILT "SUPER LIFE" ROLLER CHAIN FOR EVERY SERVICE

From tiny timers to big tough drives . . . from fractional horsepower motors to mighty giants, Atlas offers you a wide selection of durable "Super Life" roller chain and attachments—all precision-built for extra wear . . . smoother, positive power.

Singles or multiples . . . regular or heavy duty . . . standard or extended pitch . . . steel, stainless steel or bronze, you'll find the rugged chain you need in the complete Atlas line.

Precision-made from specially selected steels, Atlas gives you longer life in every link. Pins and bushings are *case-hardened*, each link plate and roller *toughened*—by an exclusive Atlas heat-treating process. Built-in stamina provides extra strength to take the heaviest loads—whether uniform, uneven or severe shock.

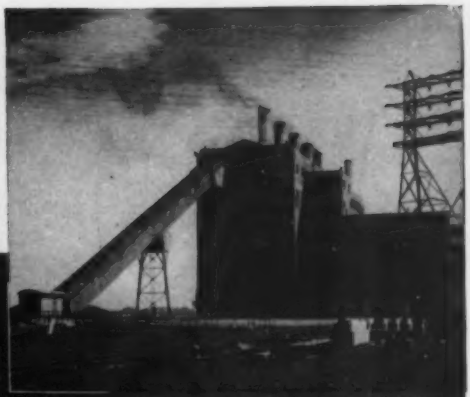
Whatever your requirements, you can depend on Atlas for longer wear over the long pull. An Atlas engineer will gladly recommend the right roller chain for years of efficient, trouble-free service.

ATLAS CHAIN AND MANUFACTURING CO.
Philadelphia 24, Pennsylvania

Send For New Roller Chain Fact Book No. ARC-52IP

ATLAS ROLLER CHAIN

To Safeguard Your Plant
COAL HANDLING MUST BE RIGHT
Buy Time-tested Units



This power station of a large Public Utility depends upon Jeffrey coal and ashes handling machinery for day-in and day-out service. They can take no chances. At left, a Jeffrey Belt Conveyor and below a Jeffrey Weigh Larry.

- Ash Handling Systems
- Belt Idlers
- Bin Valves
- Bucket Elevators
- Car Pullers
- Chains and Sprockets
- Crushers and Coke Sizers
- Conveyors — Apron, Belt, Drag, Pivoted Bucket, Spiral and V-Bucket types
- Drive Arrangements
- Feeders — Apron, Belt, Spiral Electric Vibrating
- Pulverizers
- Silo Storage Systems
- Skip Hoists
- Track Hoppers
- Transmission Machinery
- Weigh Larries

Breakdowns are costly . . . failure especially during peak-load periods can be just as disastrous as the failure of the power generating equipment. We know that coal handling machinery must be right . . . have hundreds of installations to prove it. Let Jeffrey safeguard your plant . . . there is an efficient system (or unit) for every type and size of plant. Also equipment for taking away the ashes. For greater efficiency and savings in cost . . . better see us.

THE JEFFREY MANUFACTURING COMPANY

Established 1877

814 North Fourth St., Columbus 16, Ohio

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Jeffrey-Galion (Pty.) Ltd., Johannesburg, S. A.
The Galion Iron Works & Mfg. Co., Galion and Bucyrus, Ohio
Galion (Great Britain Ltd.), Wakefield, England
The Ohio Malleable Iron Co., Columbus, Ohio
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1877 75 YEARS 1952

Because you use *the same* **"ECONOMY** *De-Lay"* Cartridge over and over again.

You renew a "blown" **ECONOMY** *Fuse* by simply inserting an inexpensive "ECONOMY DE-LAY" *Renewal Fuse Link* in the old Cartridge.

You reduce "lights out" and "machine down time" because **"ECONOMY** *De-Lay" Fuse Links* are replaced in a few seconds.

Your investment in **"ECONOMY** *De-Lay" Fuse Links is much smaller than the investment required* if you use non-Renewable Fuses for each fuse replacement.

Ask for the ECONOMY *Catalog and Price List.*

SM71

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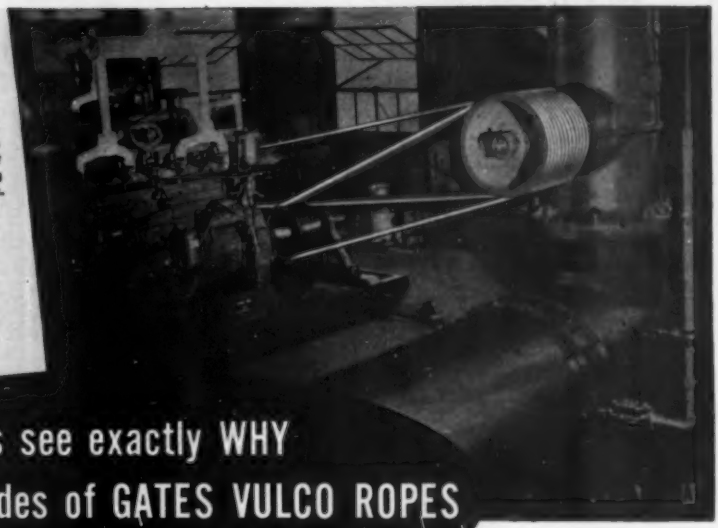
Your Electrical Wholesaler has "ECONOMY DE-LAY" Renewable Fuses and Renewal Links in stock.

ECONOMY FUSE AND MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS REPRESENTATIVES IN ALL PRINCIPAL CITIES



To drive one of the new high capacity pumps which removes surface water and runoff from 15,000 acres of Illinois farmland, members of the District Board chose Gates Vulco Ropes, running from two diesel units.

Let's see exactly WHY the Concave Sides of GATES VULCO ROPES mean lower V-Belt Costs!

Every engineer knows how a V-belt *changes shape* when it bends around a pulley.

The top of the belt is under tension—making it grow *narrower.*

The body is under *compression,* causing the sides to bulge out!

Look at figure 1-A in the diagrams, herewith. There you see how a *straight sided* V-belt is forced to bulge in its sheave-groove—and this bulging naturally causes extra wear along the middle of the sides as indicated by the arrows.

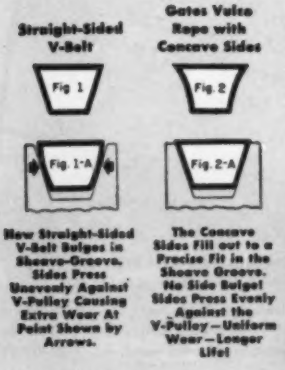
Now look at the figure 2-A. There you see how the precisely engineered Concave Sides fill out to an exact fit in the sheave groove.

Clearly, the Concave Sides press *evenly* against the V-pulley. This means uniform wear; longer life! The Concave Sides have *full traction;* wear longer because of *full contact!*

To sum up: The Concave Sides of Gates Vulco Ropes (U.S. Patent No. 1813698) give you (1) Less wear, (2) More pulley contact, (3) More sure power transmitted when needed!

Only V-belts made by Gates are built with concave sides. Whenever you buy V-Belts, be sure you get the V-Belt with the Concave Sides—The Gates Vulco Rope!

What Happens When a V-Belt Bends



How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear At Point Shown by Arrows.

The Concave Sides Fill out to a Precise Fit in the Sheave Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley—Uniform Wear—Longer Life!

CS-521

World's Largest Maker of V-Belts

Gates®
Hose V-Belts
Molded Rubber Goods
for Industry

VULCO ROPE DRIVES
ENGINEERING OFFICES AND JOBBER STOCKS
IN ALL INDUSTRIAL CENTERS

THE GATES RUBBER COMPANY • DENVER • U•S•A

Get Dry, Clean Air the Positive Way

Entrained moisture and dirt in compressed air just don't *find* a way to get through a Cuno MICRO-KLEAN Air Line Filter.

As the cutaway shows, the air entering the filter first encounters a baffle (A) which deflects some moisture down outside the cartridge.

Then the air is forced into the porous fibre structure of the cartridge (B), being required to make many sharp turns through ever-narrowing passages, impinging eventually on the fibres.

The moisture promptly drains off these non-wicking fibres into the large collection chamber (C).

Fewer Cartridge Changes

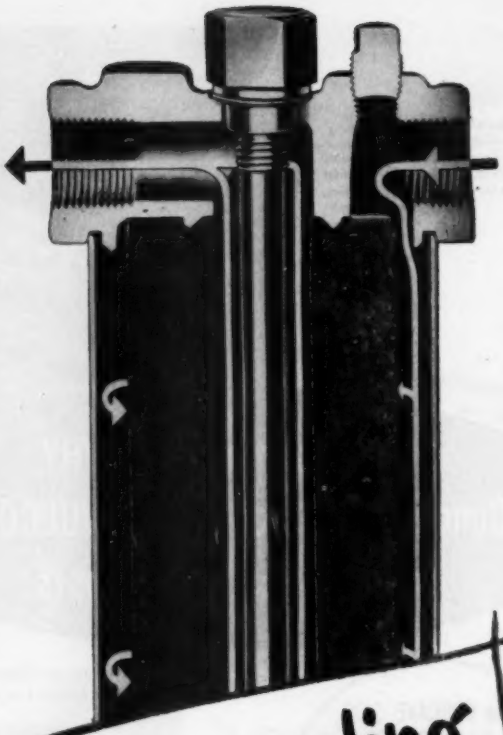
There's more room for dirt in the MICRO-KLEAN cartridge . . . meaning you need to change it less often—*half* as often.

That's because its exclusive construction—"graded density in depth"—reduces surface loading and permits smaller particles to penetrate to varying depths.

Pressure drop across the cartridge is slight due to the openness of the structure—80-90% porosity—and to the absence of purely structural components (none needed) that offer resistance to flow.

Test Cuno MICRO-KLEAN Air Line Filters on your equipment—pneumatic tools, air-operated instruments, spray systems, etc.—and be *sure* of dry, clean air.

Cuno Engineering Corporation
Dept. 148D, South Vine Street, Meriden, Conn.
Please send information on Cuno MICRO-KLEAN
Air Line Filters for.....
(mention application)
Name.....Title.....
Company.....
Address.....
City.....Zone....State.....
Please attach to business letterhead



No Channeling with this micronic filter

Won't shrink, won't swell. Won't harden, won't soften. Won't distort in any way. That's Cuno MICRO-KLEAN . . . the filter that outlasts any other replaceable-cartridge filter 2 to 1!

CUNO

Removes More Sizes of Solids from More Kinds of Fluids

Strain fuels, lubricants, process fluids, etc.—AUTO-KLEAN
Filter fuels, lubricants, process fluids, etc.—MICRO-KLEAN
Clean raw water, recirculating water, etc.—FLO-KLEAN

Fluid Conditioning

STOP RUST! with RUST-OLEUM

Every *rustable* metal surface needs **RUST-OLEUM**—the *exclusive* formula *proved* in all types of industry, at sea, above and below ground for over 25 years! Goes on easily by brush, dip or spray . . . dries to a *firm, elastic, decorative* finish that resists salt air, rain, snow, heat, fumes, smoke, etc. **RUST-OLEUM** may be applied *directly over surfaces already rusted without removing all the rust!* Simply scrape and wire-brush to remove rust scale and loose particles. Sandblasting and other costly preparations are not usually required. So easy to use that one man often does the work of two! Specify **RUST-OLEUM** to your contractor, architect or maintenance department. Prompt delivery from Industrial Distributor stocks in principal cities.

RUST-OLEUM CORPORATION
2475 Oakton Street • Evanston, Illinois

RUST-OLEUM BEAUTIFIES AS IT PROTECTS — AVAILABLE IN ALL COLORS, ALUMINUM AND WHITE

FREE SURVEY: Place your rust problems in the hands of a **RUST-OLEUM** specialist. He will conduct a survey, including *applications, specific tests,* and *recommendations. No cost or obligation.* See Sweets for catalog and nearest **RUST-OLEUM** distributor, or write for literature on your company letterhead.

CLIP THIS COUPON TO YOUR LETTERHEAD MAIL TO:

RUST-OLEUM CORPORATION
2475 Oakton Street • Evanston, Illinois

- ☐ Have a Qualified Representative Call.
- ☐ Full Details on FREE Survey.
- ☐ Complete Literature.
- ☐ Nearest **RUST-OLEUM** Source.

IT'S PACKED
WITH SATISFACTION
WHEN IT'S PACKED
WITH R/M

Whatever your packing problem . . . gaskets for a Freon condenser like this one . . . or packings for service against high pressures, high temperatures, chemicals, refrigerants, petroleum, milk or other special fluids . . . Raybestos-Manhattan has a packing or gasket designed for the job. Check your R/M Packing Catalog, or call your nearby R/M distributor.

R/M PACKINGS

RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Crawfordsville, Ind.; Passaic, N.J.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Mechanical Rubber Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Sintered Metal Products • Bowling Balls

Before You Buy Blow-off Valves ASK THESE QUESTIONS...

EDWARD BLOW-OFF VALVES
Design simplicity . . . operating ease, low maintenance cost . . . stay tight, no trick construction. ASA pressure classes 300, 600, 900-1500, 2500 lb. Sizes 1½", 2" 2½"—straightway or angle flanged or socket welding ends—Stellite or Evalloy trim.

Q. *In a tandem blow-off valve hook-up, will both valves stay tight?*

With Edward, the valve nearest the boiler is the same design as its mate. Both are "sealing" valves.

Q. *Is the packing out of the highest temperature zone?*

Edward blow-off valves have only one set of packing, for the stem is the only working part that needs to be packed. Packing is above a condensate cooling chamber, removed from highest line temperatures.

Q. *Do the valves have backseats, so that packing can be replaced in service?*

With Edward, the answer is "yes".

Q. *Can leakage start through bonnet misalignment?*

Not with Edward blow-off valves. The Edward one-piece bonnet has no yoke posts to permit distortion.

Q. *Are parts of both blow-off valves interchangeable?*

Edward answers "yes". And with fewer working parts Edward blow-off valves need less maintenance. If part replacement is necessary, repairs are easier and less expensive with Edward.

Q. *Can the seat and disk bind together?*

Not Edward, because the disk lifts off the seat on operating instead of grinding against it. There is no sleeve to gall against the seat.

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY
EAST CHICAGO, INDIANA

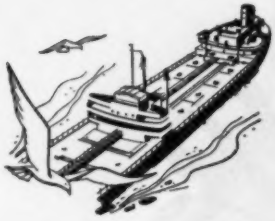
Another Product

Edward built the first steel blow-off valves. Installation records in America's major steam plants for nearly 50 years tell this story—no blow-off valves are better designed for year-in, year-out service with low maintenance. Write for Edward blow-off valve catalog, No. 12-D.

40 West 144th Street
EAST CHICAGO, INDIANA

American Blower . . . a time-honored name in air handling

Tampa, Fla., has a conveniently located American Blower Office to provide you with data and equipment for air handling. You can reach American Blower in Tampa by calling 2-2506. In other cities, consult your phone book.

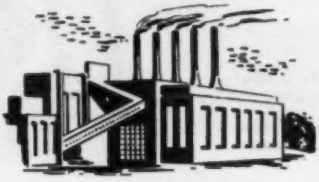


BON VOYAGE

The very fact that the cargo is *potentially* dangerous requires every precaution for safety on an oil tanker. American Blower fans and blowers more than meet the rigid specifications for ventilating equipment on these vessels. American Blower ventilating equipment includes explosion-proof motors, spark-proof fan wheels and housings and carries Certified Ratings. If this touches on a problem you're facing, our nearest branch office will be glad to help you.

HOSPITAL COMFORT

A new Veterans' Hospital recently completed on the west coast is going to be mighty comfortable for patients — at least from the standpoint of good ventilation. American Blower Sirocco Fans are largely responsible. These fans deliver more air per revolution than any other type of fan, operate at lower tip speeds, are quiet, and require only minimum space for installation. Our branch office personnel are experienced engineers who will be glad to furnish complete data on American Blower equipment. Why not call today?



POWER PLANT NEWS

An American Blower Type ST Fly Ash Precipitator was purchased recently by a leading public utility for installation on the world's largest boiler now under contract. It is a pulverized-fuel fired, dry-bottom type boiler having a continuous rating of 1,450,000 lbs. of steam per hour capacity. The boiler is expected to burn about 147,000 lbs. of coal per hour with a gas volume of 600,000 cfm going into the American Blower Collector. At this rating, approximately 13,000 lbs. of fly ash per hour will be caught in hoppers and transported to storage tanks.

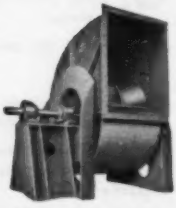
If you're planning to enlarge or expand your facilities, if you're changing from civilian to military production, let American Blower supply you with air handling products to improve comfort and boost efficiency. Phone or write our nearest branch office.

Unit Heaters

Mechanical Draft Fans

Dust Collectors

Gyrol Fluid Drives

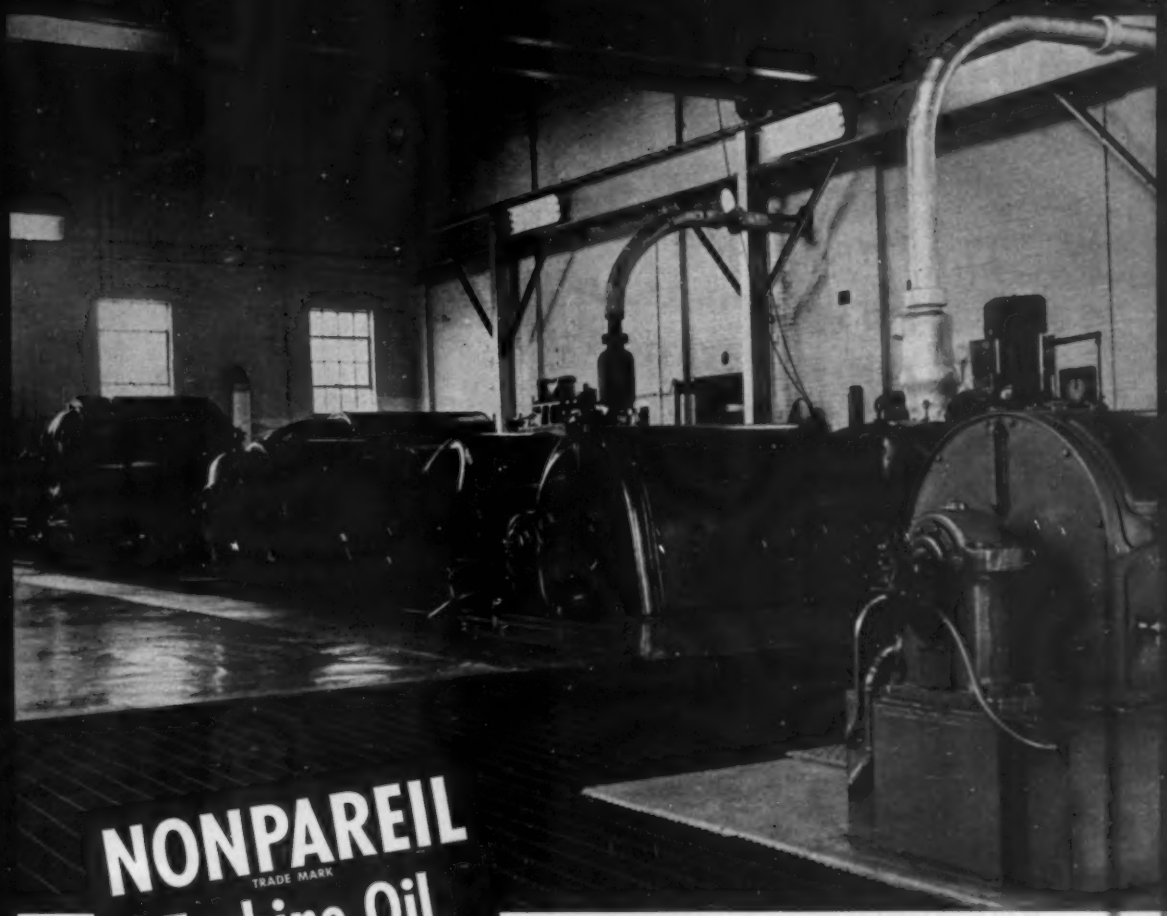


Industrial Fans

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

YOUR BEST BUY **AMERICAN BLOWER** AIR HANDLING EQUIPMENT

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • BOSS HEATER • THAWANDA IRON



NONPAREIL
TRADE MARK
Turbine Oil

Completes first 20 years on this job

AFTER TWENTY YEARS of service in the first turbine installed by a midwest power plant, the original fill of NONPAREIL Turbine Oil is still on the job. There's no retirement in sight for this veteran.

During this time the acidity number has never exceeded 0.10 mg. KOH/gm. Removal of the oil for treating or for cleaning of the turbine lubricating system has never been necessary, and make-up requirements have remained at a minimum. That's low-cost, trouble-free turbine lubrication . . . the same kind of lubrication these plant operators are getting in three newer turbines with NONPAREIL.

There's no time limit on results like these when you use NONPAREIL. It's guaranteed in writing to last as long as the turbine itself, and the neutralization number is guaranteed never to exceed 0.15 mg. KOH/gm. For low-cost, trouble-free lubrication of *your* turbine, ask your Standard Oil lubrication specialist to explain the advantages of NONPAREIL. Let him show you operating records covering periods of continuous service well over twenty years. Call your nearest Standard Oil Company office. Or write: Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Ill.

STANDARD OIL COMPANY STANDARD *(Indiana)*

The Largest Demineralizer

USED IN A PUBLIC UTILITY CENTRAL STATION IS A

GRAVER

Exhaustive studies by the Philadelphia Electric Co. Engineers of all water purifying methods and equipment designs led to the selection of a Graver Demineralizing plant for the Schuylkill Station.

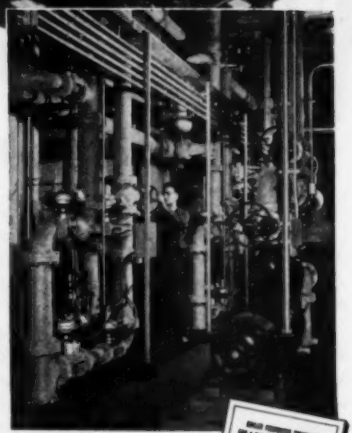
The requirements . . . . . boiler feed make-up 1250 gpm for 1250 psig boilers.

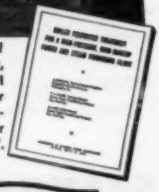
The purpose . . . to supply heating needs in downtown Philadelphia, serving 600,000 lb per hr make-up to high pressure boilers and topping turbines.

The Graver plant has been in operation since late 1950. Typical of Graver performance and guarantees are the following results:

	Raw Water	Graver Guarantee	Graver Performance
Dissolved Solids, ppm	**220**	**less than 8**	**1.5-2.0**
Silica, ppm	**13**	**less than 0.3**	**0-0.2**

Doing better than expected is a Graver habit . . . demonstrated by all types and sizes of Graver Water treatment plants. To make sure that *you* have "better than expected" results, consult Graver about *your* water problem.





For complete description of this demineralizing plant, write for free technical article "Boiler Feedwater Treatment for a High-Pressure, High Make-up Power and Steam Producing Plant".

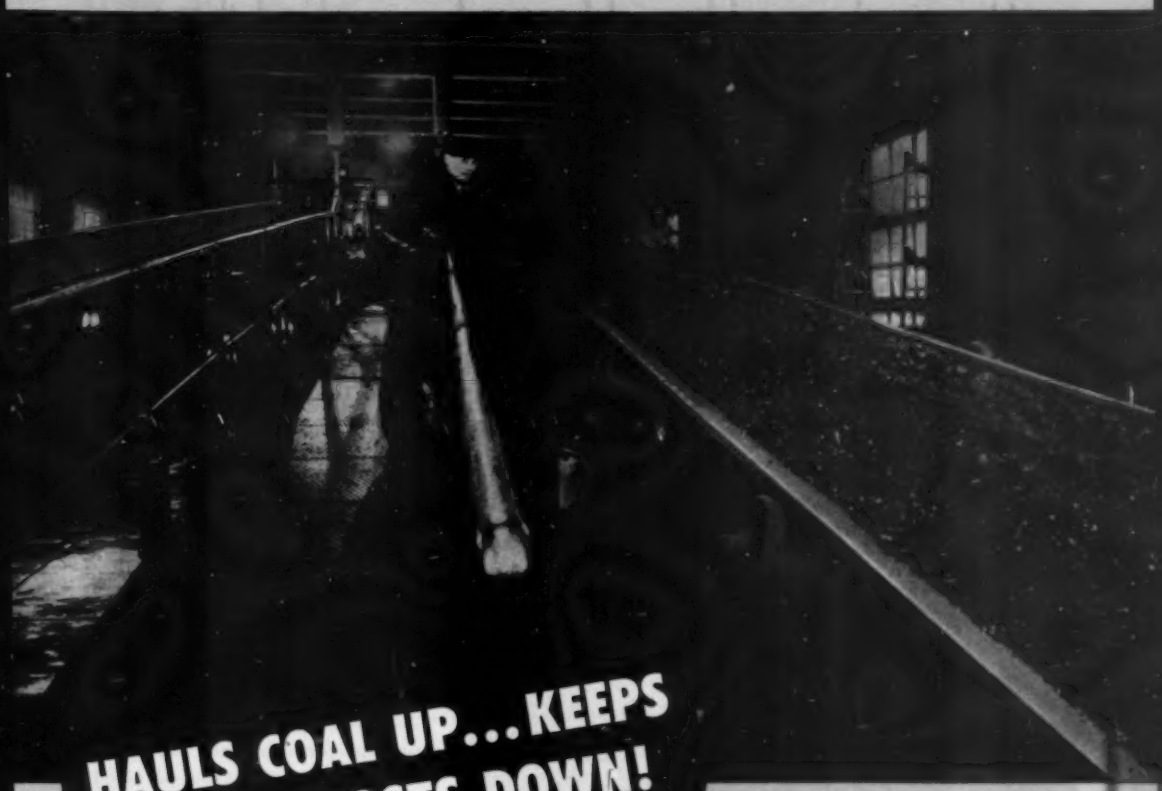
GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

Dept. IP-D, 216 WEST 14TH STREET, NEW YORK 11, N. Y.

GRAVER

QUAKER *Production-eered** BELTING



HAULS COAL UP... KEEPS POWER COSTS DOWN!

QUAKER CONVEYOR BELTING

HAULS 3700 TONS A DAY... STANDS TOUGH WEAR... GIVES EXTRA LIFE

Spinning faster than the speed of sound, the hungry turbines in this Philadelphia power plant devour more than 86 million lbs of steam a day. An endless stream of coal—some 3700 tons daily—is fed up a 775-foot incline by a 30-inch "Production-eered" Quaker Ebonite Conveyor Belt.

"Production-eered" to take the worst abuse and give the best performance hauling the heaviest belt-beating loads, this Quaker Belt is a model of low-cost production efficiency. Tough, resilient covering, outstanding flexibility in all weather, ease of troughing—all make Quaker Belts the choice of leading power plants across the nation.

Just one more example of Quaker "Production-eering" at work. Let an experienced Quaker "Production-eer" help you boost production, cut costs—with Quaker "Production-eered" hose, belting, packing and molded rubber products.

***Production-eering**—Every Quaker Industrial Rubber Product is "Production-eered"—engineered to provide maximum life, efficiency and production on each type of installation. Quaker "Production-eers" are ready to recommend the right rubber product for the right job. For timely production tips, get the new free booklet on Production-eering for Industry. Write today.

Get This Book

QUAKER RUBBER CORPORATION

DIVISION OF H. K. PORTER COMPANY, INC.

PHILADELPHIA 24, PA. · BRANCHES IN PRINCIPAL CITIES

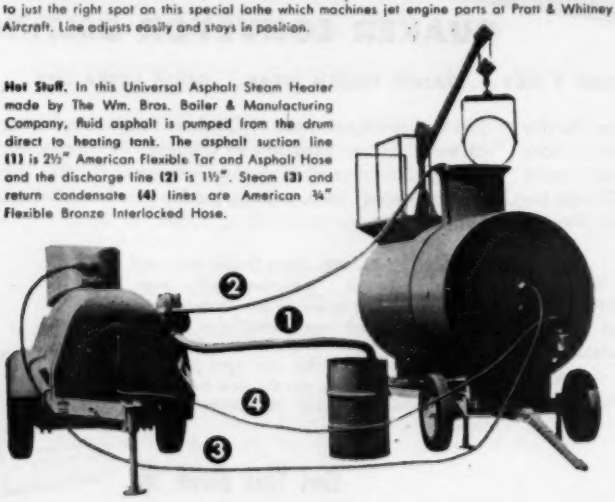
How in the world would **you** have solved these connector problems?

Coolant gets a new twist. A quick twist, and American Flexible Metal Tubing conveys coolant to just the right spot on this special lathe which machines jet engine parts at Pratt & Whitney Aircraft. Line adjusts easily and stays in position.

Would you have relied on costly, clumsy, rigid piping? Thrown up your hands? Or – like the resourceful designers of these three machines – would you have used flexible metal tubing? In each case American Flexible Metal Hose or Tubing filled the bill . . . and cut operating costs.

Your product, too, may need versatile, flexible American Metal Hose. If it must move, bend, or vibrate, let us show you the right connector...designed to absorb vibration, connect moving lines, or to be assembled in close quarters, while resisting heat, cold, pressure and corrosion in conveying liquids, gases or semi-solids. Write for Bulletins SS-50 and CC-300 which give technical details and many application histories. The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Company, Ltd.

Hot Stuff. In this Universal Asphalt Steam Heater made by The Wm. Bros. Boiler & Manufacturing Company, fluid asphalt is pumped from the drum direct to heating tank. The asphalt suction line (1) is 2½" American Flexible Tar and Asphalt Hose and the discharge line (2) is 1½". Steam (3) and return condensate (4) lines are American ¾" Flexible Bronze Interlocked Hose.



Pull-out is a push-over to repair. Tyler Fixture Corp. neatly solved the problem of permitting quick inspection and easy repair of the refrigerating unit in their freezers. Entire unit pulls out, yet refrigerant lines remain connected – thanks to American Seamless Flexible Bronze Tubing.

wherever connectors must move

ANACONDA

American **FLEXIBLE METAL HOSE AND TUBING**

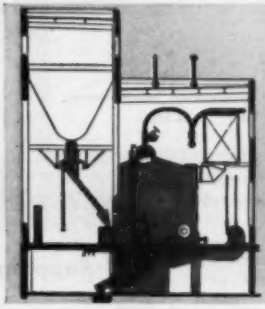
"74.2% MORE STEAM PER DOLLAR—

that's what this modern coal installation gives us at Perfection Stove Co.!"

says George I. Chittenden, consulting engineer for the Perfection Stove Company.

Perfection's old installation, if operating today, would generate 1,362 lbs. of steam per hour per dollar. The new plant produces 2,373 lbs. of steam per hour per dollar. Here's proof of the economy and efficiency of bituminous coal burned with modern equipment.

This view of Perfection Stove's new steam plant shows the coal elevator and ash silo. Coal is delivered through an under-track hopper, lifted by elevator to storage. A pneumatic system carries ashes to the silo.



This sectional drawing of the plant's boiler installation shows the coal bunker over the firing aisle. A weigh larry with dust-proof connection feeds coal to the stokers. The plant is clean and efficient—typical of the modern design that makes full use of coal's inherent advantages.

If you operate your own steam plant, you can't afford to ignore these few down-to-earth facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

● More and more consulting engineers are advising their clients that *bituminous* coal is the best buy for steam fuel. *Here's why:* Nearly everywhere coal yields more BTU's per dollar . . . modern combustion installations step up this inherent economy . . up-to-date coal- and ash-handling systems cut labor costs to a minimum.

Tremendous reserves give coal a future dependability of supply no other fuel can offer. And to mine this coal, America has the world's most productive and efficient coal industry—making coal the one fuel most likely to remain reasonably stable in price.

If you're building or planning to modernize a steam plant, call in a competent consulting engineer. He'll show you how a modern coal installation can save you money and do a more efficient job, too!

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
WASHINGTON, D. C.

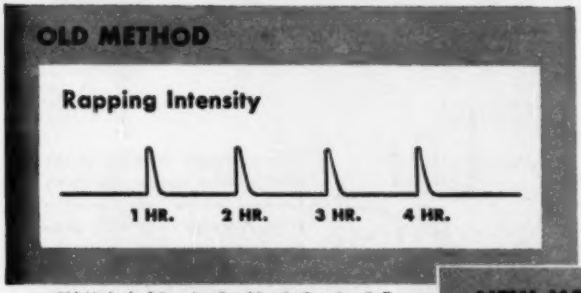
FOR HIGH EFFICIENCY ★ FOR LOW COST

YOU CAN COUNT ON COAL!

New Development

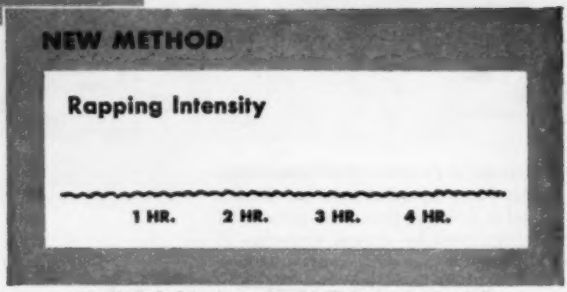
FOR ELECTRICAL PRECIPITATORS

ELIMINATES RAPPING PUFFS



Old Method of Rapping Resulting in Rapping Puff

Here are two simple diagrams that clearly demonstrate the importance of the new method of rapping developed by Research Corporation. The first shows the old way in which dust is shaken loose from electrodes at *periodic* intervals, causing intermittent puffs or clouding.



New Method of Continuous Rapping Eliminating Rapping Puffs
Rapping Intensity

This second diagram illustrates the new scientific method of cleaning electrodes. It involves continuous or sequential rapping, every minute or less, at a controlled vibrational intensity. This converts precipitation from a batch operation to a *continuous and uniform process.*

This is another major contribution by Research Corporation to the field of electrical precipitation. Constant research and development work for the past 39 years has resulted in many other improvements over the first Cottrell Precipitator. These advances plus the unequaled experience gained through over 1000 installations, listed at right, assure you of a profitable solution to your specific problem.

RESEARCH CORPORATION INSTALLATIONS

55 Carbon Black Plants
208 Metallurgical Installations
215 Acid Plants • 34 Paper Mills
293 Detarring Installations
251 Power Stations
86 Steel Plants • 114 Oil Refineries
and Miscellaneous Installations

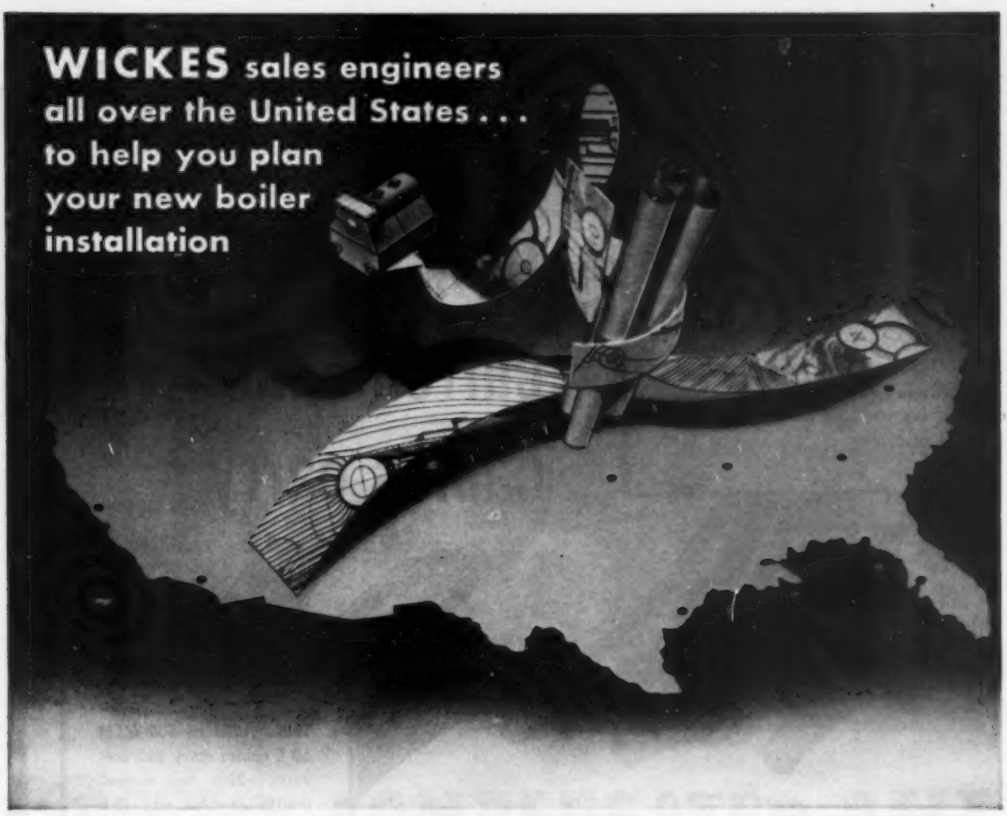
Want to know more about the new Rapping System? Bulletin FA contains additional data. Send for your copy.

RESEARCH CORPORATION

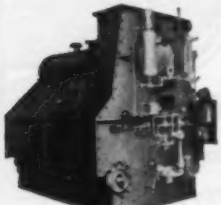
405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois
Bound Brook, New Jersey

RC-133

WICKES sales engineers all over the United States . . . to help you plan your new boiler installation



In twenty-three principal cities in the U. S. and in several industrial centers outside the country there is a Wickes sales engineer—who really knows boilers—ready to help you. This widespread sales organization, alone, helps greatly to increase the service you get from Wickes, and once you place an order for a Wickes boiler, Wickes engineers and production men get into production without delay. Wickes knows that when you want steam generating equipment, you want it. A Wickes installation is a complete installation. One contract covers all controls, all accessories, all engineering, all work from original survey to final brick-work and installation ready-to-go. ✓ ✓ ✓ Throughout the world, industries and institutions that depend on steam have learned to depend on Wickes for efficient, low cost steam power. Wickes can fill your requirements for steam generating equipment up to 250,000 lbs. per hour and 1000 psi.—all types of multiple drum boilers adaptable to any standard method of firing. Write today for complete information or consult a Wickes sales engineer.



WICKES THE WICKES BOILER COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

SALES OFFICES: Atlanta • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Detroit • Greensboro, N.C. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Pittsburgh • Portland, Ore. • Saginaw • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D.C.

141

RECOGNIZED QUALITY SINCE 1854

These 500 MCM Deltabeston AVA cables carry 470 amperes —150 amperes more than standard 60 C cables of the same size. This can mean more current from your present conduit—extra current from every pound of copper.

How much extra current can AVA cables carry?

These standard 500 MCM 60 C cables carry 320 amperes — 32% less current than the same size G-E Deltabeston* AVA cables. Deltabeston cables permit operation at increased temperatures — offer more current per pound of copper.

If you're planning new distribution or changes in your existing wiring system, it will pay you to look into the savings of G-E Deltabeston AVA cable. Deltabeston can actually offer as much as 64% more current from your present raceways—can offer more current in most wire sizes.

Famous G-E No. 1799 varnished cambric and double-asbestos insulation make Deltabeston suitable for operation at high temperature. That's why *at normal ambient temperatures* it can handle more current than ordinary types.

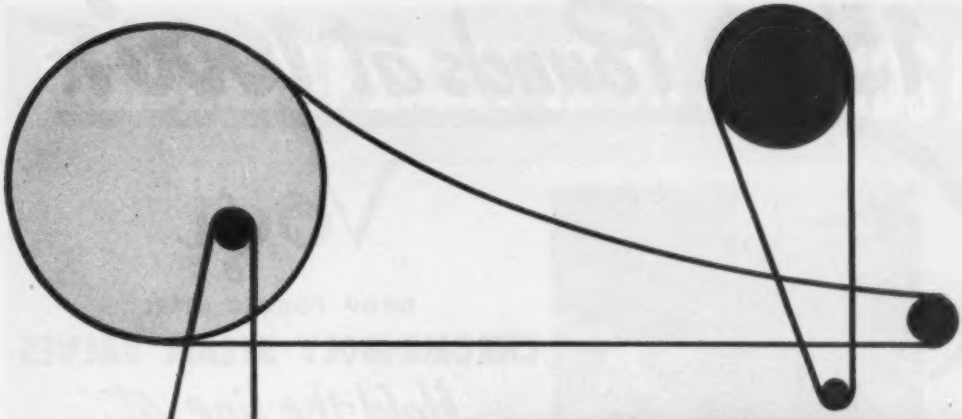
Before you wire or re-wire, check Deltabeston AVA cable. For information get in touch with your local G-E Construction Materials distributor, or write Section W24-544, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

** Registered Trade-mark of General Electric Company*

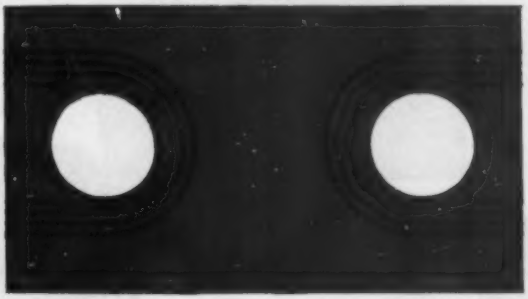
Deltabeston
WIRES and CABLES
Built to beat the heat

You can put your confidence in—

GENERAL ELECTRIC



MORE PULL IN EACH PLY

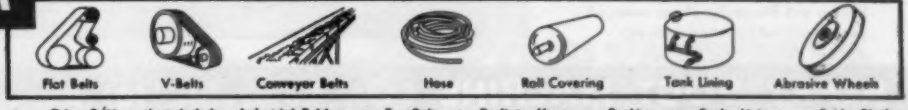


Condor COMPENSATED BELT

What causes outer ply rupture and fastener failure? It's shown in the sketch above. With ordinary belts the inner plies loaf around the pulley while the outer plies do the work. This unequal ply-loading is the cause of most transmission belt failures • In Condor Compensated each ply pulls its share of the load, because R/M engineers have found a way to equalize the ply stresses. This principle makes Condor Compensated Belts outlast ordinary belts and increase fastener life on some drives by as much as three or four times • Bulletin 6808J describes other advantages. Write for it . . . or better still, let your R/M Distributor tell you about it.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Packings • Brake Linings • Brake Blocks
Clutch Facings • Asbestos Textiles • Sintered Metal Parts • Bowling Balls

1500 Pounds at 1000°F.

Vogt

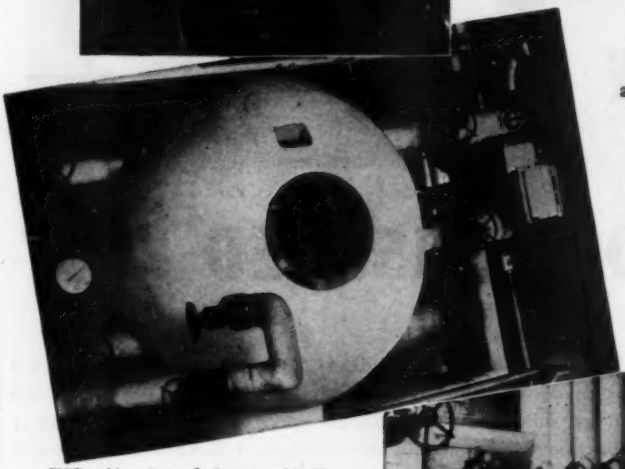
DROP FORGED STEEL

CHROME-MOLY STEAM VALVES

Hold the line at...

Oswego, N. Y. Station of

* NIAGARA MOHAWK POWER CO.



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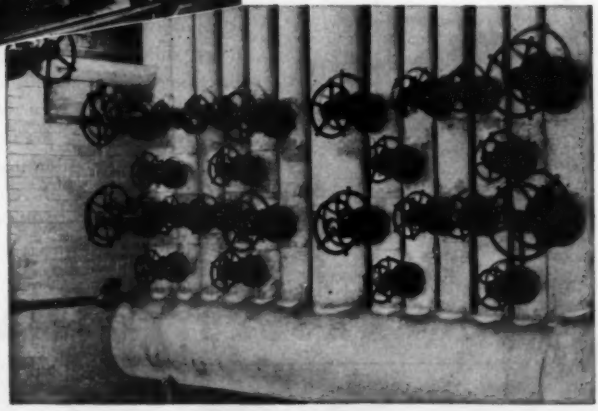

TOP: Air view of Oswego, N. Y. Station of Niagara Mohawk Power Co.

CENTER: Valves on main drum of 875,000 pounds per hour steam generator.

RIGHT: Drains from main steam, attemperator, and superheater lines employ a maze of valves.

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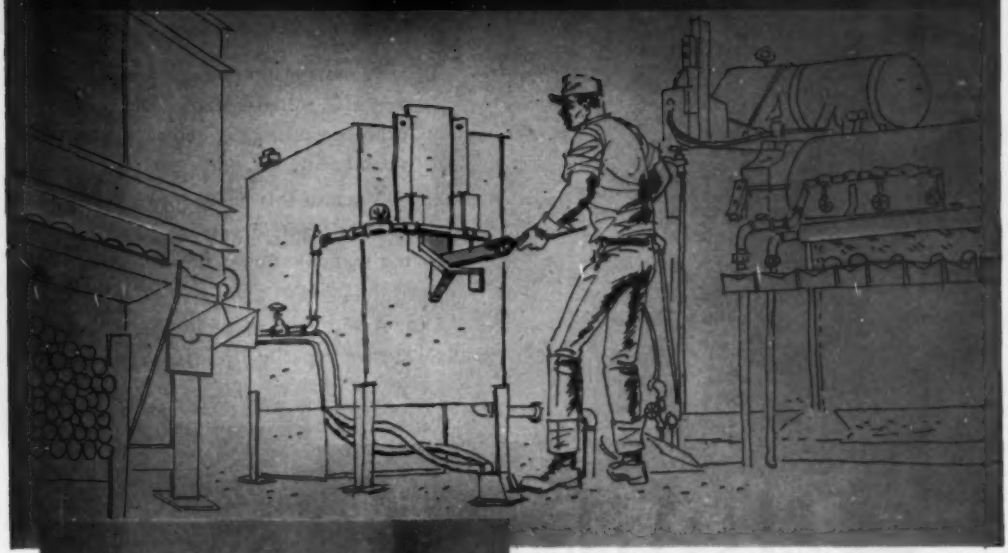

This automobile plant uses two BJ Hydropress Pumps for descaling. One pump services as many as 10 cabinets (with 5 operating at once).

Auto industry uses BJ Hydropress Pumps to descale forged parts hydraulically!

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The BJ Hydropress pump is ideal for this type of work because of its unique construction features. It does not require relief valves, accumulators or extra heavy fittings and piping. Its double volute design creates inherent balance at all heads and capacities. Its vertical construction allows the use of a simple foundation and a minimum of floor space.

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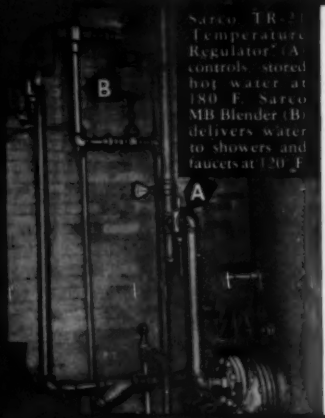
Don't Waste It



Sarco TR-2 Temperature Regulator (A) controls stored hot water at 180° F. Sarco MB Blender (B) delivers water to showers and faucets at 120° F.

In most plants and institutions hot water is stored for periodic use in process work, gang showers, group wash basins, etc.

Much of this water (often carried at 180 or 200° F) is wasted by allowing manual temperature adjustment at the point of use.

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They add cold water to the hot from the storage heaters to secure the exact temperature desired at the point of use. In effect, storage capacity will be increased by preventing waste.

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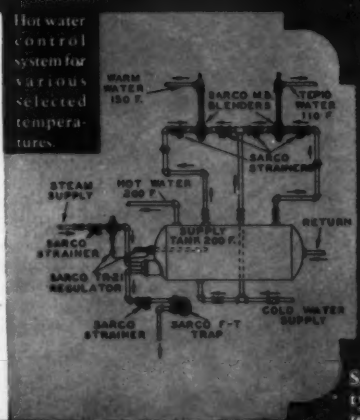
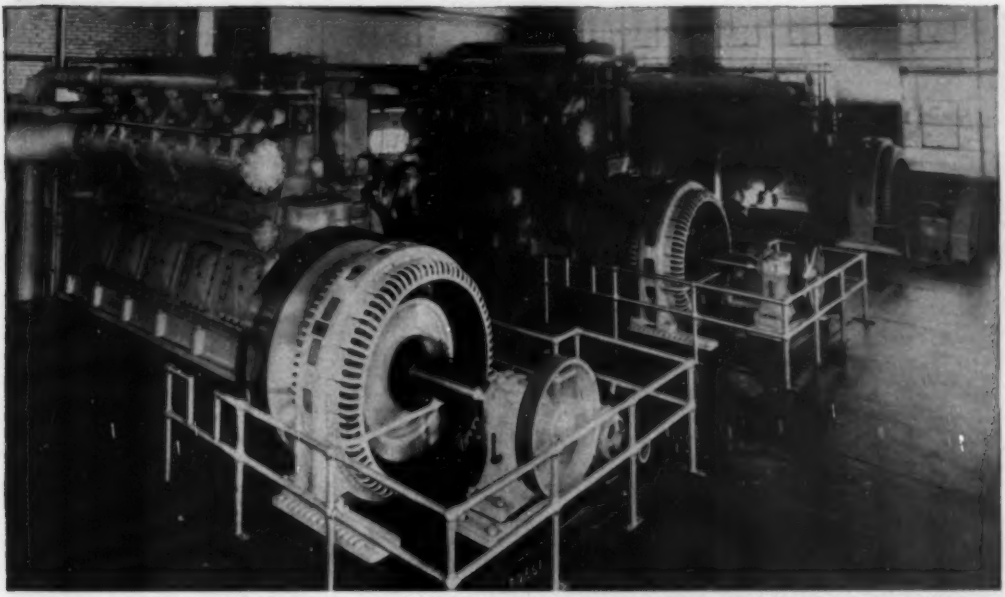


Hot water control system for various selected temperatures.

Sarco Water Blender type MB provides tempered water at any desired constant temperature.

Sarco Water Blenders

344



ENGINES IN FOREGROUND ARE ORIGINAL UNITS installed in 1939. Background engine is the latest supercharged unit installed in 1950. Another supercharged unit, placed in service in 1947, is not shown in this view. The output of this plant has increased from 952,600 kw hrs for the first year to 3,792,900 kw hrs for the year ending December 31, 1951.

Power plant is financial asset for city of Odessa, Missouri

PROFIT used to pave streets, pay off water and sewage bonds, operate water department, and to pay for power plant itself.

Odessa, Missouri, is an agricultural trading center 38 miles east of Kansas City.

In 1939 the town took a big step—they started operation of a power plant that has since provided the small part-farm, part-suburban community with continuous, dependable, economical power. And equally important, it brought new income that did more than pay for power plant operation.

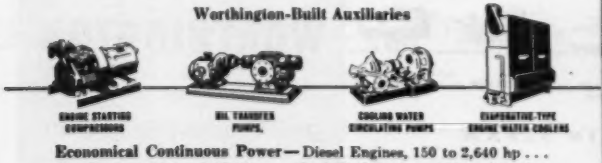
It also helped pave the streets, pay off water and sewage bonds, and is paying off the cost of the new plant itself.

In spite of the high profitability of plant operation, rates have been lowered twice, and are today as low as can be found anywhere in the state.

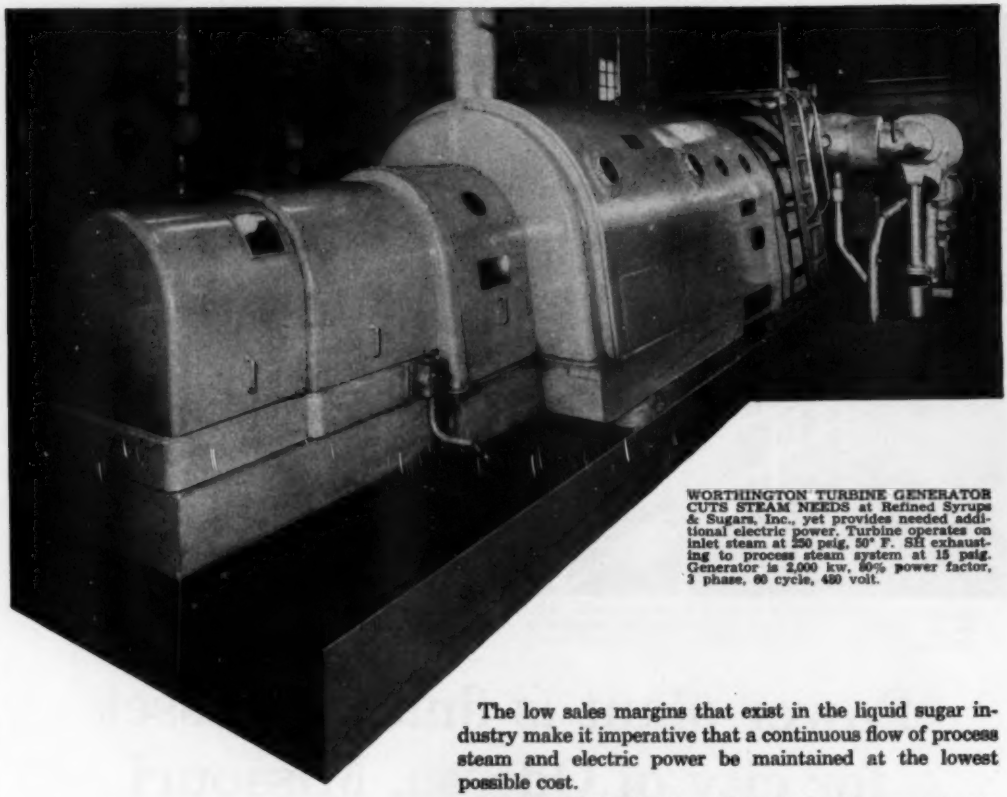
Much of the credit for the success of the plant goes to the high operating efficiency of the four Worthington Diesels. After the two original units had been in service about eight years, the first supercharged engine was installed in 1947. An additional supercharged unit was placed in service in 1950. Present output of the plant is 13.5 kw hrs per gallon with a load factor of 69.5%. The two supercharged engines—at this same load factor—averaged 14.0 kw hrs per gallon.

If you are interested in learning more about how modern Diesels, dual fuel, or high compression gas engines can help you reduce your power bills, write to Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.

E-2-3



Economical Continuous Power—Diesel Engines, 150 to 2,640 hp . . . Gas Engines, 190 to 2,880 hp . . . Dual Fuel Engines, 150 to 2,640 hp.



WORTHINGTON TURBINE GENERATOR CUTS STEAM NEEDS at Refined Syrups & Sugars, Inc., yet provides needed additional electric power. Turbine operates on inlet steam at 250 psig, 50° F. SH exhausting to process steam system at 15 psig. Generator is 2,000 kw, 80% power factor, 3 phase, 60 cycle, 480 volt.

How Refined Syrups & Sugars got more kw, yet cut steam consumption per kwh by 29%

The low sales margins that exist in the liquid sugar industry make it imperative that a continuous flow of process steam and electric power be maintained at the lowest possible cost.

It was with this fact in mind, and a need for more electric power at economical rates, that Refined Syrups & Sugars of Yonkers, New York, replaced existing steam drives with electric motors and installed a modern Worthington 2,000-kw steam turbine generator.

Not only did this arrangement meet the need for added power requirements, but also reduced the amount of steam consumed in generation of power by 29% per kwh.

By going "Worthington", Refined Syrups & Sugars—like the many other Worthington users—found that unit responsibility has its rewards. Each Worthington turbine generator is designed, assembled and tested *as a complete unit* before shipment.

Sizes to 10,000 kw. Worthington Corporation, formerly Worthington Pump & Machinery Corporation, Steam Turbine Division, Wellsville, New York.

T.2.17

A GREAT TEAM IN STEAM

WORTHINGTON

Steam Turbine Generators

STAINLESS STEEL DEAERATING TANK is hoisted in place during construction of one of Detroit Edison Company's Heating Plants at Detroit, Michigan.

When CO_2 Caused a Headache ...Worthington Cured It

Detroit Edison had the solution to its problem—the problem of CO_2 in its steam—except for one thing.

Zeolite-softened municipal water used in their steam plant contains high percentages of carbonates which decompose and generate CO_2 in the boilers. Carried over with the steam into heating and processing equipment, that CO_2 could cause plenty of trouble.

The CO_2 problem was solved by Detroit Edison engineers by acid treating the softened water, converting the carbonates to CO_2. The gas thus formed is driven off in a deaerator.

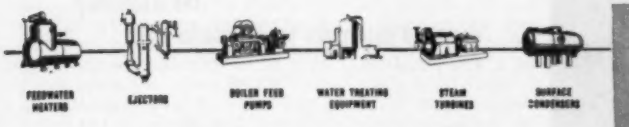
However, no standard deaerator could successfully remove the large quantities of CO_2 released by the acid treatment, and deliver water to the boiler with practically zero oxygen and zero CO_2. Furthermore, standard materials would have lasted only a few months under such conditions.

NON-CONTAMINATED STEAM

Worthington provided the answer. Detroit Edison engineers selected a Worthington deaerator specially designed for these severe conditions, built entirely of stainless steel, and guaranteed to deliver water containing not over 0.005 ppm of oxygen and not over 0.1 ppm of CO_2. The result is steam containing so little CO_2 that the amount *cannot be accurately measured!*

On problems like this one, Worthington not only furnishes *all* of the equipment needed in a complete water treating installation, but also has the engineering ability to work with your engineers on the *complete* problem of generating steam for power or processing. For further information on why *there's more worth in Worthington*, address Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, New Jersey.

5.1.2



A GREAT TEAM IN STEAM

WORTHINGTON

Feedwater Heaters

PLASTIC goes to press FASTER

"The use of Yarway Impulse Steam Traps on our platen presses has speeded up our production rates to such an extent that it almost appears we have developed an entirely new process."

That's the Chief Engineer of a large Michigan plastics fabricating plant speaking . . . and he backs up his words by standardizing on Yarways throughout the plant three months after making a trial installation.

You may be surprised at how much faster your product can be produced when Yarways trap your steam equipment. Yarway Impulse traps are designed with production in mind. They insure sending maximum B.T.U.'s at top temperature into your process or product. They get equipment hotter, *sooner* . . . and keep it hot!

Yarway Impulse traps are small, easily installed, good for all pressures, made of stainless steel, require minimum maintenance, cost little.

Try Yarway Impulse traps yourself. Stocked and *sold* by 216 Industrial Distributors. For steam trap advice, call your nearby Yarway trap engineer.

YARWAY

the steam trap
designed with more production in mind

YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.

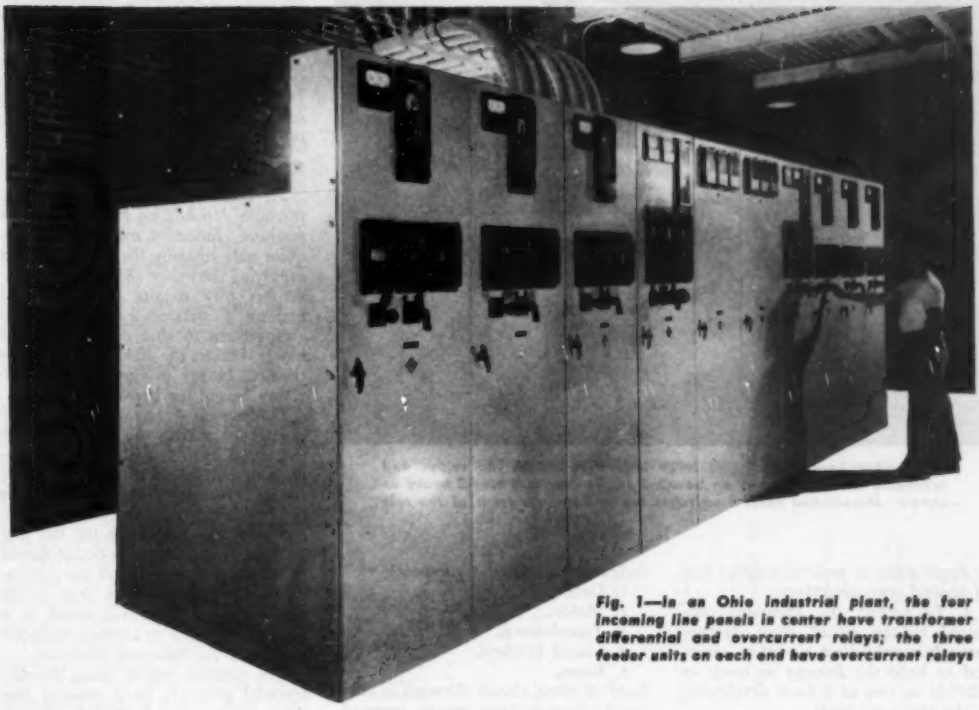


Fig. 1—In an Ohio industrial plant, the four incoming line panels in center have transformer differential and overcurrent relays; the three feeder units on each end have overcurrent relays

Selection of . . . .

PROTECTIVE RELAYS FOR SWITCHGEAR

Protection provided by power breakers depends greatly on the relays that initiate their operation. Here is a survey of the types available, with a discussion of their applications, for use in modern industrial plant electrical distribution systems

H. V. NYE, *Switchgear Section, Allis-Chalmers Manufacturing Company*

EXTENSIVE USE of distribution voltages of 2300 and 4160 v and even higher, in industrial plants has been greatly accelerated by availability of high voltage metal-clad switchgear with its inherent safety features. At these voltages, however, the type of circuit breakers necessary do not have incorporated in them the essential protective features usually built into low voltage breakers commonly used on 600 v and below. Consequently, in each case it is necessary to provide for protective relays to guard against improper operation and resultant damage of connected apparatus such as motors, transformers and generators.

The fact that these protective features are not built into the circuit breakers makes it possible to have a much wider choice of the protection which may be supplied. There is practically no limit to the extent to which relay protection may be carried. There are, however, generally adopted minimum standards to be observed.

Circuit Breakers

Since circuit breakers are the device on which all relay protection is based, it is of vital importance that they be selected to interrupt the maximum short circuit which can occur at the point of application and to withstand any through current to which they may be subjected. When properly selected, they will act through functioning of the protective relays to guard the circuits in which they are located as well as apparatus connected thereto.

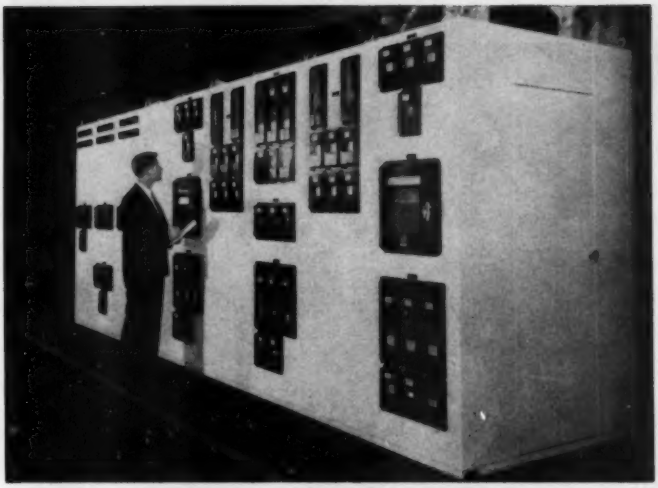


Fig. 2—For control rooms in large industrial plants, the relays and recording instruments may be mounted on the rear of a tunnel board as shown. Meters and control switches are mounted on front of the unit

Application of protective relays has, in general, two objectives:

1. To protect the apparatus connected to the circuit from damage through overloading or other cause, and to limit the damage as much as possible in case of a fault developing in the apparatus itself.

2. To provide continuity of service on as much of the system as possible when it is necessary to isolate certain equipment or circuits due to actual faults on such circuits.

Purpose of Relaying

It is of paramount importance that an insulation failure, or a short circuit from any reason, occurring anywhere in the electrical system should cause a minimum disturbance to the rest of the circuits.

The effort, therefore, is to apply protective relays at any given location so as to isolate the faulted point and keep the rest of the system operating normally. Extent to which this can be realized in practice depends on such factors as location, cost of protection and importance of the line or apparatus affected. Some circuits will justify much greater expense for relaying than less important ones.

Relay Types

For industrial use of metal-clad switchgear, relay protection provided is usually concerned with circuits and apparatus in the plant itself and varies according to equipment connected to each circuit. Usually this consists of one or more of the following classes, including associated equipment:

1. Generators.
2. Motors.
3. Transformers.
4. Circuit breakers.
5. Buses.

Each of these circuit elements is subject to damage from one or more of the following abnormal conditions for which protection can be provided:

1. Overload or overheating.
2. Overcurrents due to failures or faults.
3. Overvoltage or undervoltage.
4. Overspeed.
5. Mechanical failure not associated with electrical failure.

In case of short circuits or overcurrents which exceed the capacity of the apparatus to carry them for any extended period, relay operation which will trip the circuit breakers serving the affected circuits must be provided. Any real protection must, in general, be automatic and result in the prompt isolation of any equipment in trouble.

Table 1 lists some of the most usual types of protection furnished on standard types of metal-clad switchgear. The table shows which types are specified for standard NEMA units and which are applicable and available when required. No pretense is made of covering all types of protection, but this information may serve as a ready reference for determining what may be desirable.

Bearing Temperature Protection. The type of mechanical failure protection most commonly provided is for bearing failure. Any trouble is usually manifested by overheating of the bearing bushing. If a bearing temperature relay is mounted in each bearing, relay operation can close a control circuit which, by means of auxiliary relays, can cause the machine to shut down. In the usual case, however, an alarm sounds to advise the operator of bearing heating.

Rotating Equipment

Necessary control to stop a rotating machine depends on character of the machine. Induction motors usually require only tripping the circuit breaker supplying the motor. Synchronous condensers may require some form of braking. Generators usually require an arrangement to shut down the prime mover, remove the field and apply mechanical brakes to bring the unit to a stop before the bearings fail.

Differential Protection is generally capable of giving the most complete protection against faults in the apparatus or circuit and can take it out of service before extensive damage is done by continuing fault current. The general principle is based on the fact that the current in a device or circuit should be the same at each end of the particular circuit being protected. Any failure resulting in a fault will result in a short to ground or to another conductor and upset the balanced condition.

One common way of using this differential principle on a rotating machine requires that both ends of each stator winding be brought out so that a current transformer can be placed in each lead. If a fault to ground (on a grounded circuit) or a fault between phases should occur, current in the two terminal connections to the phase winding (and in the transformer secondaries) will not balance since the fault current will not flow in one lead.

Across the two secondaries of the current transformers, a relay is connected as shown in Fig. 3. With no potential existing between the leads (due to the same primary current), no resultant current will flow in the relay. But when currents in the two transformer secondaries are not the same, the difference will be forced

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through this relay. It will operate to close the circuit to a hand reset auxiliary relay. This, in turn, will close the tripping circuit of the breaker, and also usually open the closing circuit. The auxiliary relay may have other contacts to initiate other operations desirable in shutting down a unit or prime mover.

Current transformers for differential protection must have similar characteristics. Transformers so used should not supply other relays or instruments.

To effectively protect a synchronous machine, operation of the relay should not only open the breaker, but also deenergize the field. On a generator, it should also shut down the prime mover and stop the unit. Differential protection can be applied to either wye or delta connected machines.

With grounded three phase machines, three of the required six current transformers are in the neutral ends of the phase windings at the machine. The other three are usually in the switchgear. With delta connected machines, all six transformers should be adjacent to the machine to reduce amount of cable required.

Differential protection is recommended for all generators over 500 kva up to 5000 v, and for all generators of higher voltage.

Field Failure Protection. On synchronous machines, failure of excitation current may result in serious overheating or pulling out of step. Some method of taking the machine out of service under this condition is standard on synchronous motors. On generators and synchronous condensers used for voltage regulation, protection cannot always be based on the absence of field current, since such machines may be operated down to zero excitation or even excited in the reverse direction. In such cases, one method is to use the absence of field excitation voltage to determine when a failure in the field circuit exists.

Overcurrent Protection

Usual practice is to provide protection from overcurrents (which may result from faults) of such magnitude that the circuits cannot safely carry the current for any length of time. Most common form of protection is a current transformer and overcurrent relay in each phase. The relay operates at excessive current to trip the circuit breaker. This type of protection is simple and comparatively inexpensive.

One current transformer and one overcurrent relay is required for each phase. The transformer can also be used with other relays and instruments. The usual overcurrent relay is of the induction type and can be obtained with various time characteristics and current ranges to suit requirements.

Other overcurrent relays with additional characteristics are available to meet certain applications. Some are built with a directional feature so they will operate only when the power flow is in one direction. Others are built with voltage restraint and will operate only on greatly reduced voltage.

Generator Overload

In general, straight overcurrent protection for generators is not desirable owing to the fact that the relays are apt to open the generator breaker under conditions where it is best to remove the fault by opening a breaker servicing only the affected circuit. This situation can be helped by using overcurrent relays with voltage restraint. They may be set so they will not trip the generator breaker if the terminal voltage is maintained sufficiently high, as in the case where the fault is distant from the generator, or is a partial failure. This form of protection is used by some engineers for bus protection where no differential protection is provided on the bus.

If overcurrent protection is deemed desirable, use of voltage restraint relays is recommended. But in general, where overcurrent protection is necessary only for internal faults, it is more desirable to have differential protection. On small and intermediate types of generators, this internal fault protection is sometimes accomplished by the use of directional overcurrent relays, but it is recommended that on all generators 500 kva and over, differen-

TABLE 1. RECOMMENDED RELAY PROTECTION ON METAL-CLAD SWITCHGEAR

Type of protection	See Note No.	Type of unit: Generator	Feeder	Incoming line	Transformer	Synchronous motor	Induction motor
Bearing temperature	1	R	....	....	....	R	R
Differential	2	D	....	....	....	D	R
Differential	3	....	....	....	D	....	....
Field failure	4	....	....	....	....	N	....
Overcurrent	5	R	N	N	N	N	N
Directional	6	R	R	....	....	....	....
Voltage restraint	6	R	....	....	....	....	....
Overfrequency	7	R	....	....	....	R	....
Overvoltage	8	R	....	....	....	R	R
Phase balance	9	....	....	....	....	R	R
Phase sequence	10	....	....	....	....	R	R
Reverse power	11	R	R	R	R	....	....
Temperature	....	....	....	....	....	R	R
Thermal overload	....	....	....	....	....	N	N
Undervoltage	8	....	....	....	....	N	N

Symbols: N NEMA minimum recommendation.
D Normally recommended as desirable.
R Available when requested.

NOTES TO TABLES 1 AND 2

Tables apply to alternating-current switchgear only.

1. Machine must have bearing temperature relays mounted in bearings. Switchgear can be arranged to sound alarm or provide shutdown as desired.

2. Requires matching current transformers in each phase winding at each end of winding (six of three phase machine). Can use three relays to operate on differential current.

3. Requires current transformer in HV and LV leads, relative current ratio to correspond to transformer voltage ratio.

4. Usually inherent in motor field application control. See discussion under *Field Failure*.

5. Three overcurrent relays, may be used with characteristics to suit application.

6. Read comments under Overcurrent for application to generators.

7. Either over- or underfrequency protection can be obtained using frequency relay.

8. Either over- or undervoltage protection, or both, can be obtained with a voltage relay.

9. Desirable on motors to prevent single phase operation.

10. Certain motors must be protected so they cannot be started in the wrong direction. A phase reverse relay will prevent starting in reverse but will not shut down in case of phase failure.

11. Reverse power relays can be used to prevent prime movers being driven by their generators, and also to prevent power flow in one direction for any reason.

12. Where more than one time characteristic is indicated, relay can be obtained with any one characteristic indicated. Relays marked A are adjustable in voltage, current or time setting.

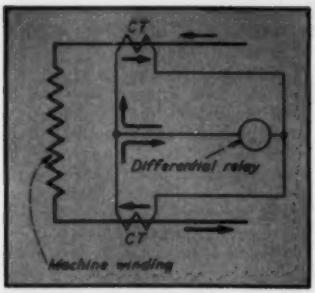


Fig. 3—Current ratio differential protection requires current transformers at each end of circuit protected. Any fault between them unbalances outputs

tial protection be furnished.

An application for directional overcurrent relays is found in the case of feeder circuits where a loop connection is used, or where there are two parallel feeders with circuit breakers at each end. In such cases, a directional overcurrent relay can be used to open the breakers if a fault develops and causes power flow into the feeder in the reverse direction.

Generator Overspeed

Overfrequency Protection. Most usual application of overfrequency protection is as an auxiliary protection against overspeed. When frequency exceeds a certain predetermined value, a frequency relay can be used to trip the breaker and initiate other operations as desired, such as close down a prime mover.

Although most prime movers have some kind of mechanical overspeed trip, overfrequency protection will guard against failure of these primary devices. Such precaution is particularly desirable in unattended stations.

Motor Overload

Overload Protection. In general, motors are usually much smaller than generating units and much more subject to being operated for extended periods under overload protection. This is usually done by using thermal overload relays. In case of sustained overloads which may be dangerous to the motor windings, they will open the circuit breaker supplying the motor. Very large motors may be provided with embedded detectors that permit the use of a temperature relay for this purpose.

In attended stations, generators are not usually provided with any overload protection as the operator can easily determine the load being carried and see that an adequate number of units are in service. Also, it is frequently desirable to carry overloads on generators for short periods.

Voltage Sensitive Relays

Overvoltage Protection. A voltage relay operating off a potential transformer can be set to operate when the voltage exceeds a predetermined value. This may be used to lower the field current (in case of voltage regulator failure) or to give an alarm signal.

Undervoltage Protection. Protection is normally supplied to prevent motors operating for long periods under conditions of serious undervoltage. If allowed to continue under these conditions they will not only overheat, but their maximum torque will be reduced, and they may not be able to pull the mechanical load to which they are connected. A voltage relay operating from a potential transformer can be used to trip the circuit breaker on low voltage.

As momentary voltage fluctuations may often occur which will do no harm, an induction type relay which will operate with a short time delay, is usually used. When the low voltage relay operates and trips the breaker, it is important that the motor is not energized on restoration of voltage until started in the usual manner.

Phase Balance, Sequence. Phase balance protection will prevent operation with one phase open and is desirable protection on most motors. When starting up a motor in the reverse direction would be dangerous, phase sequence protection is desirable.

TABLE 2. STANDARD RELAYS USED ON METAL-CLAD SWITCHGEAR

Description of relay	Type of protection, Note No.	Time characteristic, Note 12						Relay responsive to:					
		Instantaneous or no delay	Definite	Inverse	Very inverse	Extremely inverse	High speed	Current	Voltage	Power	Direction	Frequency	Differential
Auxiliary relays:													
2-circuit contacts	....	X	....	....	....	....	....	X	....	....	....	....	....
2-circuit contacts	....	X	....	....	....	....	....	....	X	....	....	....	....
Multi-contact	....	X	....	....	....	....	....	....	X	....	....	....	....
Make and break	....	X	....	....	....	....	....	....	X	....	....	....	....
Differential induction:													
Low speed	2	....	....	X	....	....	....	X	....	....	....	....	X
3-winding trans.	3	....	....	X	....	....	....	X	....	....	....	....	X
Multi-circuit bus	....	....	....	X	....	....	....	X	....	....	....	....	X
High speed	2	....	....	....	....	....	X	X	....	....	....	....	X
Frequency	7	....	....	....	....	....	....	....	....	....	....	X	....
Overcurrent (induction)	5	....	A	A	A	....	....	A	....	....	....	....	....
Overcurrent (induction)	5	....	....	....	....	A	....	A	....	....	....	....	....
Directional	6	....	....	A	A	....	....	A	....	....	X	....	....
Voltage restraint	6	....	....	A	....	....	....	A	X	....	....	....	....
Fast, no restraint	....	....	....	A	....	....	....	A	....	....	....	....	....
H.S. directional	6	....	....	....	....	....	X	A	....	....	X	....	....
Phase balance	9	X	....	X	....	....	....	A	....	....	X	....	....
Phase reversal	10	X	....	....	....	....	....	....	A	....	X	....	....
Reclosing (3 recl.; L.O.)		....	....	....	....	....	....	....	....	....	....	....	....
Reverse power	11	....	....	A	....	....	....	....	....	A	X	....	....
Temperature relay	....	....	....	X	....	....	....	Exploring coils					
Thermal overload	....	....	....	X	....	....	....	A	....	....	....	....	....
Voltage	8	....	....	A	....	....	....	....	A	....	....	....	....

A—Adjustable in time, current or voltage setting

SALVAGE AND STORAGE

Materials in the proverbial scrap pile are valuable, if reclaimed, reconditioned and orderly stored until placed into service. Extent of the organization required to carry out such a salvaging program and methods of reclaiming useable parts are outlined

MARION A. JENSEN, *Consulting Engineer*

ON ACCOUNT of the drastic scarcity of metal scrap, various basic materials, parts and equipment it becomes a distinct economic necessity as well as a patriotic duty to either release or make maximum use of all salvageable material. Dollars saved by virtue of utilization of salvageable material may prove to be more valuable than the dollar made in the normal sale of a product or service.

There is a peculiar psychology related to items that have been discarded, and the tendency is to look upon them in a most depreciatory fashion as obsolete junk or trash.

On the other hand, the opposite extreme is sometimes encountered. Then nothing is ever discarded, it is simply stored, accumulated and occupies valuable space. The possibility of utilization, in any part, becomes increasingly remote by the day.

Somewhere, between these two extremes there exists a happy medium—a method whereby obsolete and discarded equipment and material may be processed and disposed of satisfactorily at a profit.

Salvaging as practiced by professionals, ranging from huge organizations down to individuals, constitutes big business in this country, and a very profitable one, too.

In industry, we may cite the nation's railroads as pioneers in the development of efficient salvage operations. Generally speaking the predisposing factors favoring especial attention to railroad salvaging operations are: (1) high rate of wear and obsolescence (2) close management on limited budgets (3) hard fisted, practical minded executives and (4) keen rivalry between departments (divisions).

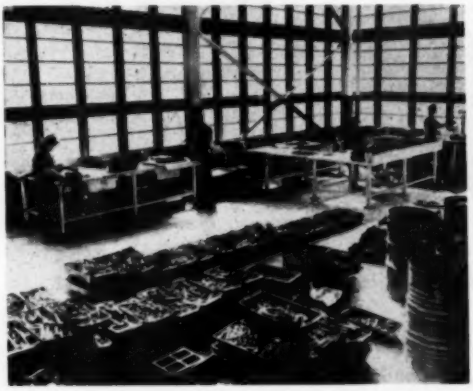
Facilities for salvage in plants will range from elaborate organizations to a plant employing less than 100 persons. Interminable number of cases usually present individual problems.

In the broadest sense the methods for carrying on salvage operations can be classified into three groups: (1) plants employing in excess of 5000 persons, (2) those employing 500 to 5000 persons and (3) small plants of under 500 personnel.

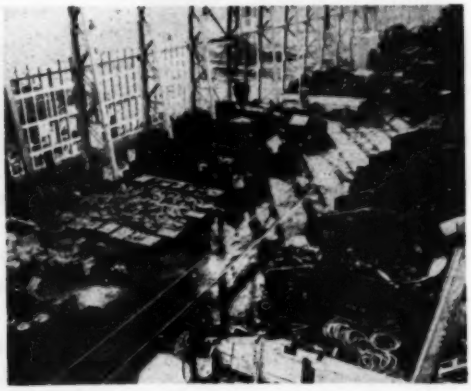
In large plants the salvage operations are best handled by means of a separate department headed by a competent superintendent reporting directly to the factory manager. The general

Materials obtained by shearing slugs and large scrap ends are classified and stored and reissued by the stock room

Sorting and classification bins permit ease of reclamation and disposal through sales to interested parties



Up-to-date salvaging crews complete their labors by placing parts in separate containers when conditioned



Knowing where scrap material is stored is an important factor in its ultimate use. Bins prove most economical

responsibility of such a department would be: (1) to collect all waste and obsolete material and equipment at the source, (2) to process and remove all usable components from the waste material and deliver it to stores department, or in the case of scrap material arrange for its sale and (3) to receive all obsolete equipment and arrange for its disposal. However, before equipment is disposed careful consideration should be given to the possibility of its uses within the plant.

Waste materials obviously vary according to the type of industry involved and the nature of the manufacturing processes. First there are wastes from machining, punching, stamping and trimming operations.

Small quantities of trimmings, punchings or stampings may be packed in returnable boxes, barrels or drums for marketing. In some cases, the purchaser provides containers and collects material at the source. When quantities are large, baling in a specially designed press provides the best preparation for market.

Steel cuttings usually contain cutting oils, and in this event not only is the salvage value of the product available but a large portion of the oil can be reclaimed. When quantities justify, the cuttings are passed through a hammer mill and reduced to uniform chip size. Next they pass through a centrifugal and steam bath. The whirling action and steam continues until the chips are devoid of free oil. Hot condensate and oil are drained into separating vats, and later the oil is purified and returned to stock. The chips pass through a press and are formed into a dense, hard briquette.

Wood shavings, stub ends of wood stock, sawdust or paper trimmings are most effectively handled by means of a pneumatic exhaust system. Wood shavings and sawdust are marketable. Sawdust is packed in standard burlap bags, and the shavings are baled. If sizable quantities are present, the combination may be collected and transported to an elevated central point. There the shavings and sawdust may be separated and segregated by means of separators. Each can be spouted to baling and bagging machines while the remainder flows to bins for consumption in furnaces.

Paper trimmings or any other light weight, nonabrasive material may be transported in a manner similar to that prescribed for wood waste. However, separate systems would be required for each class of material handled.

Sweepings of almost any description may be efficiently handled by means of a properly designed exhaust system, provided of course, that the quantities produced justify the installation. The exception is when the sweepings contain particles of ferrous material, screws, bolts, nuts, washers or nails. Combination of metals and combustible sweepings constitutes a distinct fire hazard as sparks can be created by the metal contacting the duct walls while in rapid motion. Obviously, the remedy in such cases is to first separate the offending material by means of a mechanical separator.

Generally, all sweepings should be passed through a separator in order to recover such material as invariably finds its way to the floor. Numerous designs of separators are available for this purpose. These may be classed as the rotary type and the vibrating type. If the sweepings consist principally of light combustible fines, they should be passed over magnetic separator. Vibrators operate on the basis of sizing through various screens, and to some extent, relative weight of particles.

Materials released by virtue of construction or maintenance operations contribute in no small degree to salvage possibilities. Almost everything on the list is included such as: shafting, rods, bars, hangers, bearings, pulleys, sheaves, belting, bolts, nuts, wire, cable, timber, lumber and numerous other material. Unfortunately, this material is seldom in the free state. It is usually an integral part of some structure or article that first must be razed or disassembled.

Disassemble

The secret of profitable salvage lies in the skill, care and judgment in (1) disassembling (2) processing and (3) stocking. Each structure or assembly should be analyzed and the manner of construction noted, then proceed to disassemble in the reverse sequence. Above all spare the sledge. Bolted joints will usually yield to an application of penetrating oil, and in this manner all parts can be saved. Stubborn bolts can be forced to yield by the application of heat. Riveted joints can be negotiated by clipping off the heads with a cutting torch and yet avoid burning a gash in the plate. Small rivets are best severed by means of a "B and O" and a sledge.

Welded joints must, of course, be severed with a cutting torch. However, making two cuts, one on each side of the joint as close to the work as possible, is the best procedure. In this manner the piece salvaged is free of the old welded joint, which is certain to cause trouble when the salvaged plate is reused. Of course, there are exceptions where welded joints are within a section of plate to be salvaged. Obviously, such joints need not be disturbed.

Salvaged plates should be neatly squared with a cutting torch, and any rough edges should be removed with a portable grinder. Plates that are out of level should be straightened. This is accomplished by blocking the piece on a structural shape with bulged side uppermost and then applying heat uniformly to the bulge or bend from the under side. When sufficiently heated, the bulge or bend may be driven back by means of a heavy sledge. If either a forming press or a piston hammer is available the straightening operation may be greatly simplified.

Sheet metal may be reclaimed when the shapes are not too small. Such portions as are profitably reclaimable can best be removed by cutting with a hand shear. The edges should then be squared in a squaring shear, and if necessary straightened on a heavy plate with a composition or wooden mallet.

Structural shapes should be cut to usable lengths and the ends squared. If bent or warped, heating with a torch and applying force at the correct location will straighten out most items. Heat must be applied slowly and uniformly on the outside of the bend. Lighter structural shapes can be placed on an anvil or similar surface, and bent portions can be brought into alignment with a sledge.

Nails and spikes can be extracted if unclinched, and a claw bar of correct design is utilized. Flats and rounds should be cut to usable lengths. Shorter lengths can be salvaged for bolt stock and miscellaneous uses. Flats may be straightened in the same manner as prescribed for light structural shapes.

Shafting should be centered in a lathe, freed of burrs and nicks, polished and checked for trueness. With sizes over 2 in. and where bends of considerable magnitude are present, the straightening process may be hastened by the application of heat.

Timbers, blocking and lumber should be freed of all nails, spikes, bolts, loose splinters, undue roughness and squared. Mill work should be freed from all exposed nails, loose splinters and undue roughness.

Pulleys, sheaves, clutches, gears and collars should be removed from shafting and cleaned, then carefully in-

Cutting steel members is not a hit or miss proposition. Those parts to be salvaged must be cut accurately, squared and stored for future application

Metal turnings should be spot checked for nickel analysis and separated for special handling. Non-ferrous metals bring higher prices when sold as scrap

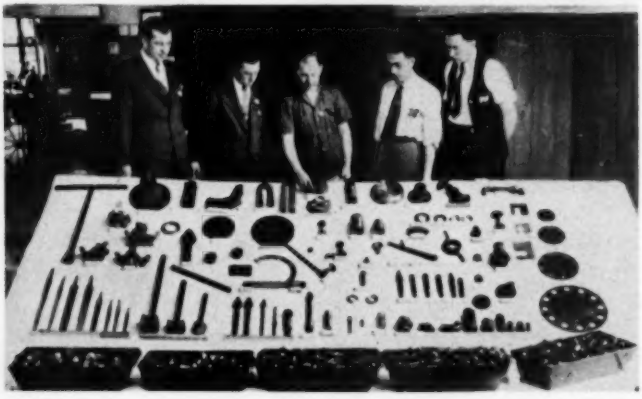
spected for defects and if necessary, repaired. All that are found unusable should be immediately discarded.

Valves, faucets, cocks and fittings should be carefully removed from pipe that is to be reclaimed. A heavy duty, square jawed wrench with ample leverage should be employed. In order to prevent distortion, heat should first be applied. Valves can usually be restored by refacing and regrinding discs and seats or refacing of gates and seats depending upon type. Faucets usually require reseating and washer replacement. Cocks should be disassembled, contact surfaces cleaned and oiled and if necessary touched up with grinding compound. The stems of the valves, faucets and cocks should be cleaned and made smooth, and the packing should be renewed. Fittings usually need only cleaning.

In the event a considerable amount of equipment can be salvaged dip tank fitted with heating coils and containing a strong solution of lye can prove effective. However, present day tendency is high pressure steam and a cleaning solution applied by means of a specially designed gun. Degreasing equipment that utilizes tri-chlorethylene is becoming increasingly popular in production shops.

Bearings and hangers should be inspected similar to that prescribed for pulleys. Babbitted bearings should be carefully gaged and if abnormal wear is indicated, they should be relined. Ball or roller bearings should first be thoroughly cleaned and then be inspected with meticulous care. When parts are found defective due to wear, pitting or chipping, the bearing should be discarded, unless of such size or type as to justify returning to the maker for servicing. When the bearing is found to be in a serviceable condition, it should be packed with the proper lubricant wrapped in oilproof paper, properly tagged and placed in stock.

Equipment discarded because of obsolescence can often be sold to used equipment dealers. Of course, this is the most desirable method of disposal providing the price offered is at least equal to the net salvage value plus 10 per cent. However, if after careful consideration there is no possible sale or reconstruction, the discarded equipment should be disassembled. The situation most favorable for disassembling of equipment is obtaining the component parts that can be stored as replacements in connection with equipment still in operation.



These numerous, and sometimes hard to purchase items, were reclaimed from the scrap pile. Careful sorting and reconditioning increase stockroom value

What to Salvage

All miscellaneous material, such as pipe, conduit, conduit fittings, switches, wire, motors and controllers should be salvaged. Motors, switches and controllers should all be disassembled, cleaned, tested and serviced in the fashion of approved electrical shop practice. Wire should be carefully inspected and graded. That found to meet electrical code standards should be properly classified and labeled. The balance should be relegated to scrap. All pipe and conduit should be carefully inspected. Material beyound repair or cleaning should be discarded or used for construction. Unusable nonferrous metal or alloys should be segrated in order that they may be sold to the highest bidder as scrap.

Organization

Plants engaged in general manufacturing and employing from 500 to 5000 persons will not, as a rule, justify a salvage department. This operation is usually made the responsibility of the plant engineer. Prevailing circumstances will dictate the type of organization best fitted to execute the degree of salvage operations required.

In the larger plants, and especially where plant expansion is heavy and the rate of obsolescence is high, the demand for salvage operations would be practically continuous. In this case, the plant engineer should place a competent person in charge of the operation,

with as many full time workers under his supervision as would be needed.

Salvage Record

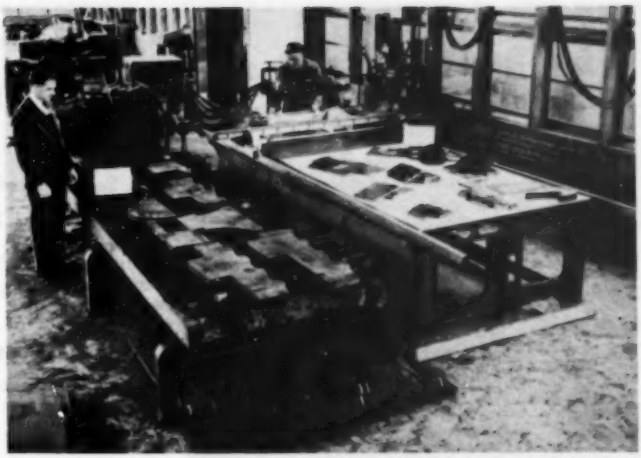
When the flow of salvage material is sporadic, the task is usually best accomplished by making each maintenance crew foreman responsible for collecting, processing, delivering and accounting for all salvageable material falling within his particular division's scope of activity. Equipment or tools for processing the salvage may be located in separate division. For example, equipment for the straightening nails, spikes and bolts would be located in the carpentry shop. Care should be taken to initiate a simple and uniform system of accounting, which will give the plant engineer an accurate status of salvage material at every location.

Miscellaneous plants engaged in light manufacturing and employing less than 500 persons—such as public buildings and public utility plants—are the most difficult to set up. The reason for this is: (1) flow of material is likely to be sporadic (2) maintenance organizations are usually small and in many cases, poorly trained and organized, and (3) generally the caliber of leadership necessary to employ the initiative, resourcefulness, determination and foresight to organize and carry on such operations is lacking. Then too, management is often inclined to consider such details too trivial to merit their personal consideration.

Processing

Obsolete material and equipment can be collected by the maintenance department and conveyed to their shop. However well the intentions of the worker may be to disassemble and salvage equipment not sold intact, he is usually too occupied with service calls and salvaging is neglected. As a result, equipment and material are pushed back into available space. This procedure usually continues until all the space is occupied and conditions become congested. The lot is then sold "as is".

Of course, such staple material as electrical equipment, usable wire, accessories, fixtures, piping, fittings, valves, plumbing fixtures and similar material is retained. All too often this material is stored intact and is not usable when needed. In such cases no attempt is made to maintain a supervised stock room for maintenance operation. Instead, supplies and parts are stored more or less haphazardly. Under such conditions salvaged material is invariably bypassed and the convenience of using new material takes preference. In addition, waste of all material is bound to ensue, and timely replacement of needed material is invariably neglected.



Cleaning and repairing dies and forming tools can be a profitable phase of the scrap crew. Old machine plates can be utilized in future construction

Establishment of a supervised stock room is a highly desirable adjunct if prompt and efficient maintenance service is to be realized. With an additional man much of the task of processing salvageable material may be executed concurrently with the duties involved in caring for the stock room.

Suitable enclosed quarters should be provided that contain a service window through which patrons may be served. Bins and shelves for the various parts and supplies should be labeled. An accounting system will insure a running inventory of stock being stored.

Tools Required

For processing salvageable material, a stoutly constructed work bench equipped with heavy duty combination pipe and jaw vises, the usual complement of heavy hand tools, an acetylene welding and cutting outfit, a small drill press and a combination grinder, wire brush and polishing stand are required. With such a setup, the right man would not only immeasurably increase the general efficiency of the maintenance department, but would reclaim a major portion of salvageable material.

The final detail in any salvaging operation is the clean-up. This includes (1) sale and removal of all intact equipment and the setting aside those parts to be rebuilt (2) reclaiming all usable parts and material, (3) separating and classifying all scrap material and (4) negotiating sales to the highest bidder or segregating parts or units to be relegated to storage.

Summary

1. Salvaging of obsolete equipment and waste material should be treated as a highly profitable operation, and one that deserves an important position on the agenda of a principal business.

2. Prevailing and growing shortages shift the necessity of efficient salvage operations into the "must" class, upon which the very success of the defense effort depends.

3. Value of obsolete equipment, waste and scrap material, from a profit standpoint, is equal to that of any other phase of a business. The importance of its reclamation or disposal should be treated accordingly.

4. Simply pushing such material away into an unused corner does not constitute efficient salvaging.

5. Efficient salvaging is an extremely flexible operation. No hard and fast rule can be laid down for its execution. The best plan for execution can only be formulated by those in charge.

6. An important point to remember, in connection with efficient salvaging operations, is to consider that properly reclaimed parts and material can compare favorably with new.

7. Possibilities of reconversion of obsolete equipment offer almost unlimited possibilities, but it must be remembered that to do this effectively, a knowledge of machine design and construction is imperative.

8. A large proportion of cases fall into the classification where a supervised maintenance stock room may be combined with efficient salvaging operations.

GETTING READY FOR THE COOLING SEASON

Servicing of the air conditioning systems at Caterpillar Tractor, Peoria Works is not a hit or miss proposition. Planning and actual operations are underway right after January 1st

HARRY B. McNEELY, ***Utilities Engineer***
Caterpillar Tractor Co., Peoria, Ill.

Pressure readings are taken in the air conditioning plenum chamber to determine static pressure increase

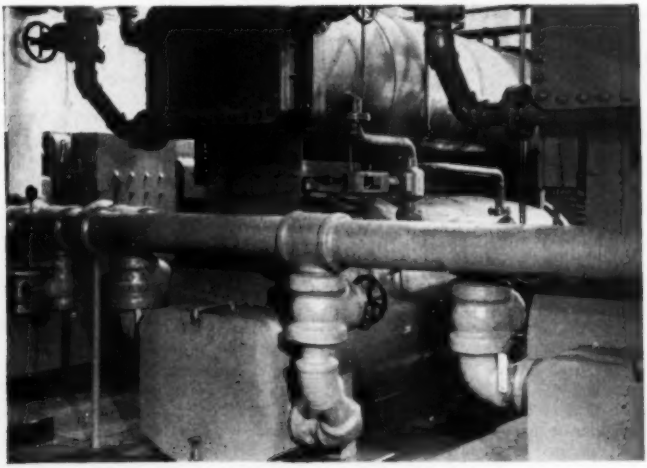
CATERPILLAR TRACTOR CO. engineers believe most arduously that planned service and operation of equipment is essential. The Utilities department, in particular, starts servicing the company's air conditioning systems on January 1st rather than waiting until the snow is off the ground and the cooling season is upon them. Of course, over 1200 ton of mechanical refrigeration requires a little doing to be placed in tip top order for a full season's operation in a location such as Peoria.

Caterpillar employs four types of air conditioning systems throughout its numerous buildings. One is the self-contained unit that is normally found for spot cooling or in a location where there is a particularly high momentary load. A good example of this would be a conference room. During normal occupation the central air conditioning system would supply the necessary cooling, but during a meeting, the self-contained unit would need to be operated to take care of the increased occupancy load.

Centrifugal refrigeration systems are employed to chill water for the main centralized air conditioning systems. This is augmented by special reciprocating systems throughout the plant. The fourth method of summer air conditioning is washed air with well water. This particular method of cooling the air is found in the plant proper, and the temperatures are not held at the usual 80 F DB.

First step in the service and operation of the principal air conditioning equipment is briefing inspection notes taken during the previous season. Inspectors of the Utilities department make their rounds daily throughout the plant, making notes as they go as to the condition and operating efficiency of equipment. These data, along with dates and brief descriptions of alterations and major seasonal adjustments, are later transferred to a "utilities equipment description card" and filed for future reference.

In all there are six equipment rooms located throughout the Peoria plant in strategic areas. Each room contains mechanical refrigeration equipment, condensers, evaporators, circulating chilled water pumps and a centralized air conditioning unit. This unit consists of the typical cooling and heating apparatus such as non-freeze heating coil, oil bath or electrostatic filter, chilled water coils, steam heating coils and distribution fans. The only difference between these various equipment rooms is the selection of manufacturers' equipment.



Centrifugal refrigeration units chill water, which is pumped to the cooling coils in a central air conditioning system that services several zones

Inspection

Inspection, as mentioned previously, is continuous, and 18 men in this department are assigned to shifts that

are on service 24 hr a day, seven days a week—covering buildings supporting 26,000 employees. Checking consists of inspection of all valves and controls for both steam and water equipment. Inspectors further check the static loss of equipment in the centralized air conditioning system.

Holes have been drilled in the sides of the centralized air conditioning chamber before and after the non-freeze cooling coil, filter section, chilled water coils, steam coils and zone re-heat coils. The static pressure drop is taken for each piece of apparatus, and when the drop is too great, as checked against a standard value, cleaning is necessary. This procedure assures proper air delivery to the conditioned space from one season to the other.

A good example of the value and usefulness of the static pressure differential is the solution of low air volumes found in one of the systems. A careful check was made of fan performance, and the fan speed was found to be in accordance with the fan manufacturer's recommendation. Coils and filter were cleaned without any perceptible increase in air volume. Static pressure drop readings were taken and checked against original conditions. It was found that the pressure drop in the coils was satisfactory, but the drop through the filter was greatly in excess of the standard value.

A thorough inspection of the supposedly clean filter revealed that lint from cottonwood trees in the area had matted on the inner portion of the filter screen. By removing the screen and burning the cottonwood lint from each individual screen section with a blow torch the condition was remedied.

Caterpillar engineers now check static pressure drops regularly throughout the heating and cooling cycle. There have been no complaints since this procedure has been put into effect.

Actual refrigeration equipment is not conditioned each year. The engineers feel that with their intensive inspection programs they have an accurate check of all mechanical equipment so as to make an accurate forecast over a year's period. If, however, a unit shows some signs of deterioration during the cooling season, the following winter it is pulled down and given a thorough internal inspection.

After mechanical refrigeration equipment has been repaired, the unit is tested thoroughly for leaks. Freon 113 vapor is pumped into the evaporator, condenser and compressor along with CO_2 vapor and held at 25 psi pressure. All covers, seals, bolt holes and other possible points of leakage are tested with a halide torch. When the tests are completed, a vacuum is drawn on the system and held for 24 hr. If no leak occurs Freon 113 is then charged into the system and the unit is ready to operate.

Condensers for these various mechanical units are flushed each winter with an Oakite solution for a period of 8 hr. Flushing is accomplished with a portable pump and tank, and liquid is circulated continuously until all lime and foreign matter have been removed from the water tubes within the condenser. No attempt is made to flush the chilled water side of the air conditioning system, as the water is treated prior to being discharged into the network. In general, the cooling water is circulated in a closed system with little water being added from year to year.

While in the apparatus room, the service crew checks all controls and especially the low load limit for the water chiller. This particular control is the most critical one in the entire system, as a suction temperature below freezing would cause a possible freeze-up and evaporator damage.

Some of the interesting procedures in the servicing and operation of the equipment are:

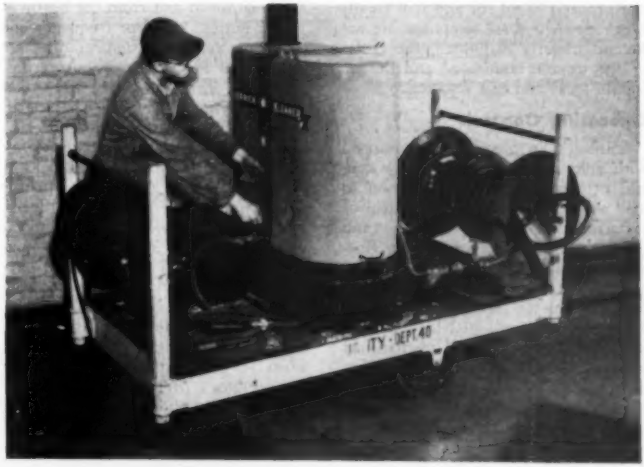
1. Non-freeze coils are blown clean twice a year, but they are inspected every two weeks.

2. Fans are inspected on a two-weeks schedule for balance, V-belt drive condition, motor performance and fan speed.

3. Sludge is removed from oil bath filters every 60 days, or oftener if inspection proves it necessary. Filter oil is changed once a year. If the filter screen is clogged it is removed and cleaned by hand with a steam jet and blow torch.

4. Valves and fittings are checked on the inspector's regular schedule. When these items are found faulty, the inspector makes an original and one carbon copy of his inspection report. The original is sent to the maintenance department, the inspector retaining the carbon copy. The carbon copy is destroyed when the service has been performed or if notified by the maintenance department of its completion.

Mechanical refrigeration units are serviced during the early winter months so as to be ready for operation long before the cooling season makes its appearance



Clean coils are a must in any air conditioning system, and this equipment offers a simple and quick method of operation with high pressure steam jet

PROTECTIVE DEVICES FOR STEAM TURBINES

Most steam turbines are equipped with automatic governing mechanisms for operating control and independent reserve devices for emergency protection. Each system is designed to perform a vital function for safe continuous operation

H. M. KING,
Turbine Engineering Division,
General Electric Co.

CONTINUOUS, satisfactory and successful operation of steam turbines is obtained only by constant, careful supervision of their operation supplemented by periodic inspections of their physical condition. The maintenance and repairs that these inspections indicate are needed must be performed promptly to insure good service.

Power generating machinery of this class is generally constructed with generous factors of safety and is capable of developing rated capacity continuously for long periods of time if proper attention is paid to certain fundamentals. These basic considerations include the condition of the steam that drives the turbine, the condition of the oil employed for lubrication, the loads imposed, the cycle of operation and proper ventilation of the generator.

In many respects these machines are like the human body in their ability to carry on. But, like the human body they will show symptoms of distress if not properly cared for and will finally break down if these symptoms are not noted, properly diagnosed, the causes of the trouble eliminated and the resultant wear and tear repaired.

Operating Controls

Turbines, in general, are equipped with automatic devices for; (a) control of steam flow in proportion to load at constant speed, (b) control of extraction and exhaust pressures and (c) prevention of reverse steam flow in extraction lines. Because a steam turbine can accelerate very rapidly if the steam energy input is in excess of that which the connected load can absorb, and since all control mechanisms may fail to function on occasion, due to lack of proper maintenance or accidental damage, turbines are also equipped with a second and entirely independent set of controls called emergency devices. These are usually set to operate at approximately 10 per cent above normal speed and are designed to positively shut off all pipelines through which steam could enter the turbine and turn the rotor.

Lubrication systems are equipped with auxiliary pumps, which automatically come into service if the primary oil pump fails. Most turbines today are also equipped with low oil pressure devices, which either sound an alarm or stop the turbine when bearing oil pressure becomes dangerously low.

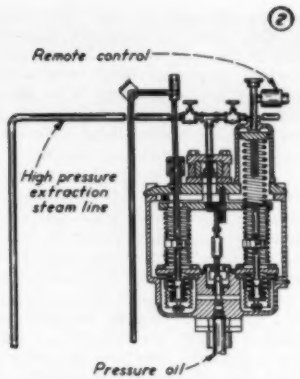
Instrumentation

Some larger turbines incorporate supervisory instruments that record eccentricity and amplitude of vibration of the shaft, relative expansion of rotor and casing and other data in which the operator is interested.

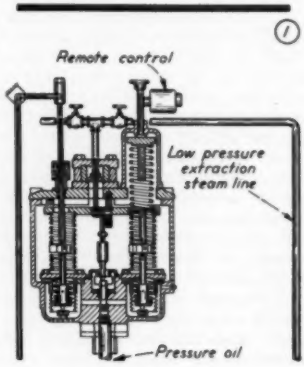
In most power plants, hourly readings of inlet, extraction and exhaust pressures, steam inlet temperature, oil temperature to and from the bearings, power output, speed or frequency and generator ventilation temperatures are entered on log sheets. While recording these items, the operator takes note of general operating characteristics and also makes notations of anything unusual that may not need immediate attention, but which should be corrected as soon as possible. In this category are minor steam and oil leaks, increases in vibration or oil temperature, irregularities in operation of governor controls and other unusual phenomena that may be observed. Any major troubles that may occur are, of course, cause for immediate shutdown.

Automatic control mechanisms, when in good working order, make the operator's life pleasant, and it is usually easy to observe whether or not they are in good working order while the machine is in operation. However, the machine should be stopped and started occasionally to make sure that these mechanisms function properly over their whole range.

Emergency or reserve mechanisms, on the other hand, are idle during normal operation. It is impossible to tell whether they are in working condition unless the machine is occasionally unloaded and the controls tested.



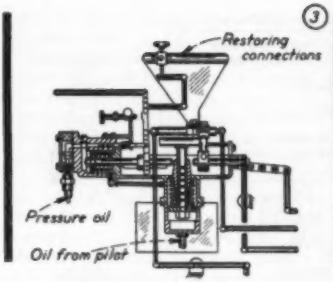
HIGH PRESSURE EXTRACTION PRESSURE GOVERNOR



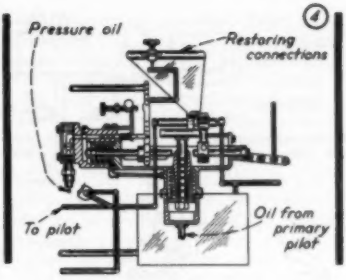
LOW PRESSURE EXTRACTION PRESSURE GOVERNOR

Emergency Controls

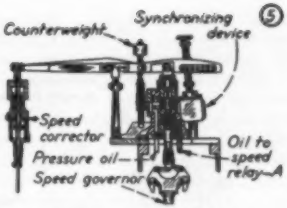
Mechanisms of this type are the overspeed trip, the exhaust and extraction pressure relief valves and the auxiliary oil pump. Any of these may become inoperative during long periods of continuous operation due to accumulations of sediment from steam, carbonization or sludging of oil, corrosion or other causes. The readiness of the auxiliary pump to start can be checked while the main turbine is operating on load by temporarily closing the oil pressure sensing line to the diaphragm of the



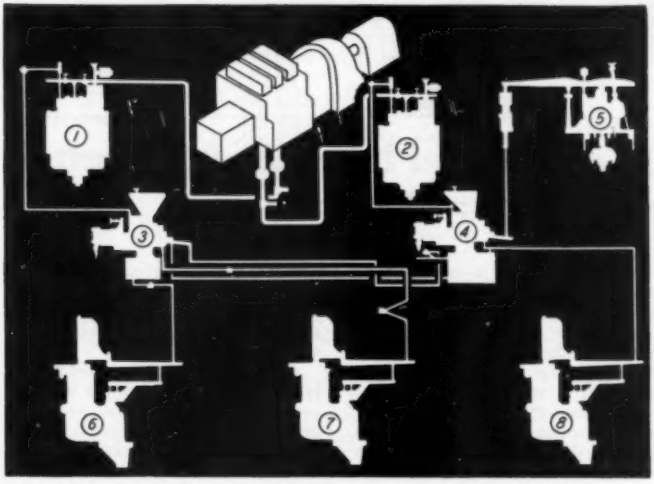
SPEED RELAY–B



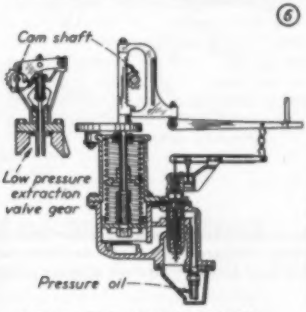
SPEED RELAY–A



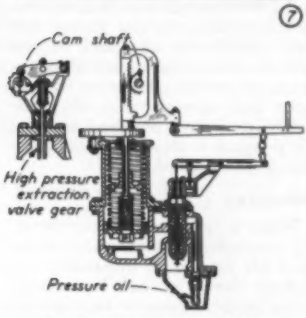
PRIMARY PILOT VALVE



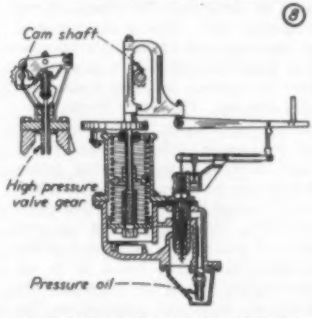
This schematic diagram and related drawings show a typical governing mechanism for double automatic extraction—condensing steam turbines



RELAY FOR LOW PRESSURE EXTRACTION VALVE GEAR



RELAY FOR HIGH PRESSURE EXTRACTION VALVE GEAR



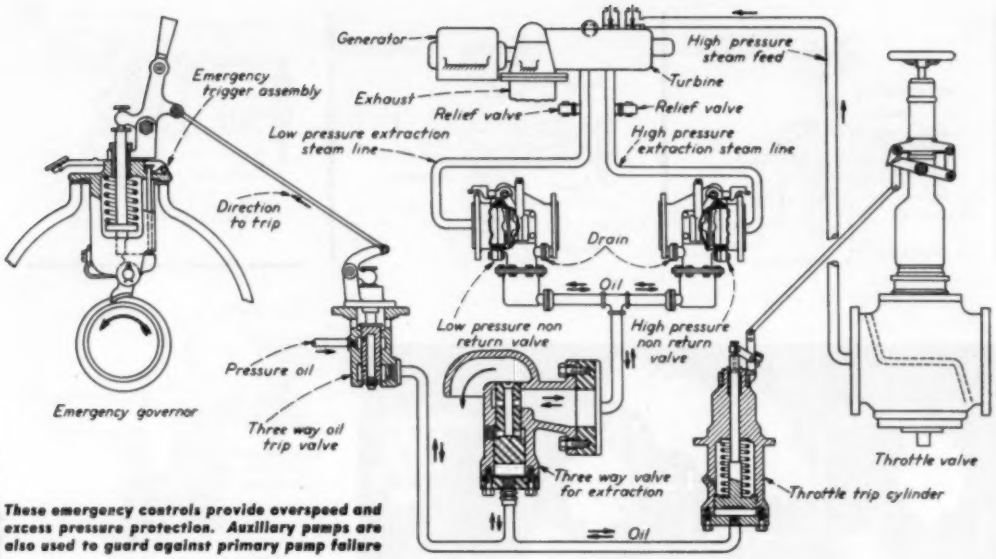
SECONDARY RELAY FOR HIGH PRESSURE EXTRACTION VALVE GEAR

auxiliary pump regulator and then bleeding down the oil pressure on the controlling diaphragm. This will cause the auxiliary pump to start and come up to speed. Shutting the bleed valve and opening the valve in the sensing line will return the mechanism to normal operation. If the auxiliary pump is valved in this manner, as some are and all can be, care must be taken that only specifically authorized persons are permitted to manipulate these valves, and that they make sure to leave the valves in the normal working position after completing the test.

Most trip stop valves are equipped with mechanisms that permit the valve to be partially closed during normal operation and immediately opened again. Trip throttle valves can be partially closed by hand until steam flowing through them is throttled sufficiently to begin to drop load and then opened wide again. Both of these tests serve to check whether the trip valve stem works freely within its packing.

If load is dropped from a turbine by opening a circuit breaker or otherwise, the normal speed governor should close the control valves and hold the speed of the machine within a few per cent of operating speed. Non-return valves in the extraction lines should also close. If, for any reason, this governor should fail to function wholly or partially, speed of the machine will increase very rapidly and cause the emergency speed governor to trip the main stop or throttle valve and usually to close the non-return valves. The emergency trip mechanism may also be arranged to open the circuit breaker and thereby disconnect the generator from the line if the overspeed is caused by motoring from other units.

It is very important that these emergency mechanisms operate properly, as steam flow in excess of that required to maintain normal speed will cause rapid acceleration of the turbine rotor.



These emergency controls provide overspeed and excess pressure protection. Auxiliary pumps are also used to guard against primary pump failure

If full load is dropped and the same steam flow is maintained, dangerous speed might be reached in a few seconds. Few steam turbine or direct connected turbine-generator rotors will stand double normal speed without failure at some point because of the increase of centrifugal stresses to four times their normal value. Hydraulic turbine-generators, however, are usually designed to be safe at double normal operating speed.

Unloading

When a turbine-generator, operating in parallel with others, is to be taken off the line in preparation for shutting down, its load is normally shifted to the other units by means of synchronizing motors on each unit in the system. If the load cannot be entirely removed from the turbine in this manner, immediate search must be made to determine the source of the remaining load. This is accomplished by checking and closing off all possible lines through which steam may enter the turbine until the load is finally dropped. The circuit breaker connecting the turbine to the line must not be opened until the load is reduced to zero, as power being generated by apparently uncontrolled steam would probably cause an overspeed condition. This could wreck the turbine and generator if the source of the incoming steam was found to be an uncontrolled line or one on which the emergency trip was inoperative. In any event, difficulties encountered in dropping load, indicate part of the control mechanism is not working properly and it is advisable to determine the exact nature of the trouble. Stopping the steam flow is a safety precaution that eliminates the necessity of placing full reliance on the emergency protective devices.

Overspeeds may be caused not only when the main throttle valve fails to trip, but also when non-return valves in extraction lines that are fed through reducing valves or other sources do not close. At normal rotating speeds turbine blade tip velocities usually range from 440 to 1100 fps or 300 to 750 mph. If these velocities are doubled by overspeed conditions and rupture takes place, the pieces leave the rotor at speeds equal to those of 45 calibre bullets to 105 mm shells. There are few turbine casings strong enough to prevent pieces of any size, moving at these velocities, from breaking through.

If pieces of any weight break out of the rotor, bad unbalance results. The hammering and vibration that follow may cause disintegration of the rotor, destruction of stationary parts, breakage of steam and oil pipes, and starting of oil fires.

Relief Valves

It is important that relief valves in extraction lines and exhaust lines be kept in operating condition. These valves are required because turbine casings are seldom capable of withstanding the boiler pressures that would almost immediately result if the valves in the extraction or exhaust lines are closed while the main throttle and governor valves are open. The dangers from a casing explosion are obvious.

Relief valves must be provided for the following locations and service conditions:

(a) On condensers connected to turbines without valves between them to protect the condenser shell and tube heads from excessive pressures.

(b) Between the turbine exhaust and any shutoff valve in this line. In the case of non-condensing turbines exhausting into pipe lines that are also fed by other sources through reducing valves, separate sets of relief valves must be installed on each side of the main shutoff valve. This provides protection for both the pipeline and the turbine casing.

(c) Between the turbine extraction opening and the first shutoff valve in the extraction line, if the turbine is equipped with internal valves that can shut off steam flow to sections of the turbine beyond the extraction point.

Auxiliary oil pumps and their pump regulators should be kept in good operating condition to guard against failure of the main oil pump. Interrupted oil flow can cause burned out bearings, shaft packings and oil deflectors. In extreme cases, distortion of the shaft may occur with resultant damage to rotor and stationary parts.

Most controls and protective devices are external components, and their operation can be readily observed. They can usually be inspected and maintained without dismantling the turbine-generator proper. It is equally important, however, to know that the internal

parts are also in good and safe operating condition.

There is no fixed rule for the proper length of time between internal inspections. For many years, annual inspections were recommended, and many public utilities and industries followed this schedule. Long experience has shown that better, more economical, equally satisfactory service can be obtained when inspections are spaced according to operating experience and observed conditions. This is particularly evident when superheated steam is utilized. Where steam is dirty or very wet, it has been found advisable in some cases to make internal inspections as often as every six months.

In any case, a new turbine should be internally inspected at the end of the first year of operation. From the condition then found, the date of the next inspection can be set, although the second period should not be longer than two years. Subsequent intervals may be as long as three or four years, if conditions warrant, but no longer.

Repairs to be made based on the inspection, fall into two classes; (a) those required for the safe and continued use of the turbine, and (b) those required to maintain economy. Each of these classifications can be further qualified as repairs required immediately or those that can be deferred until some later date, when replacement parts have been obtained and can be installed.

Highly important factors affecting the satisfactory condition of a turbine are; good housekeeping externally and internally, cleanliness of the steam, character of the load, cycle of operation and condition of the lubricating oil. Turbines that operate continuously or nearly so, are generally less liable to wear and tear than those that are shut down a large portion of the time. The latter have to be protected against leaky inlet and exhaust valves that could cause bad corrosion.

Generator inspections include cleaning stator and rotor of oil and dirt, revarnishing coils, tightening or replacing slot wedges and making insulation tests. If tests indicate short circuits in the windings or low insulation resistance between windings and the frame, repairs or dry out runs are required. In addition, the cooling system should be cleaned and tested.

Guide for internal inspection of steam turbines

1—Check shaft vibration amplitudes at load and no load before and after inspection. Correct balance or other conditions causing excessive vibration.

2—Check bearing lining clearances and condition of babbitt. Clean up any dragged spots. Rebabbitt in cases of excessive clearance or loose babbitt.

3—Drain and thoroughly clean lubrication and hydraulic operating systems. This recommendation applies not only to oil tanks and bearing pedestals, but to oil coolers, piping and the hydraulic mechanism that controls valve operation. It is foolish to only partially clean a lubricating system. Fresh oil is liable to pick up sludge that is left in the uncleaned sections and carry it along to plug bearing lubrication orifices, thereby cutting off the flow and causing damage. It may also clog pilot valve orifices and cause erratic governing. After thoroughly cleaning the system and polishing any corroded spots down to bright metal, all parts continuously exposed to oil vapor should be given a protective coating of oilproof paint or varnish.

4—Check nozzle and bucket clearances and make sure they are within the manufacturer's tolerances. If not, correct them, particularly those that are less than the normal specified standard.

5—Thrust bearings should be checked for clearance, wear and any other faults. It is particularly important to correct insufficient or excessive end play. If babbitted thrust plates show dragged or cracked babbitt, they should be re-babbitted or replaced. Re-babbitting should be done in accordance with manufacturer's instructions.

6—Rotors should be indicated for trueness and checked for cracks by kerosene and whiting or magnaflux methods. In turbines operating at high inlet temperature, rotors should be checked for loose or moved wheels that could cause trouble.

7—Buckets should be checked for cracks, looseness in their attachment to rotor or casing and for wear. If considerable wear is found, notations should be made to obtain replacements for installation at the next inspection, or when further wear makes it advisable. Rough, water cut or saw toothed bucket edges should be filed smooth to prevent fatigue cracks from starting at the notches and to stop corrosion fatigue. Buckets should be cleaned of deposits by washing, blasting with alumina, fly ash, nut shells or very fine sand or by scraping.

8—Nozzles and diaphragms should be cleaned of all deposits and thoroughly inspected for wear, erosion, and water cutting. Worn and ragged edged nozzle partitions should be filed or ground smooth to prevent pieces from sloughing off and damaging rotating parts. Eroded steam joints should be repaired. Diaphragms and nozzle partitions should be checked for cracks.

9—Packing rings should be removed from their cells, cleaned and inspected. Worn or damaged rings, supporting springs or bands should be replaced.

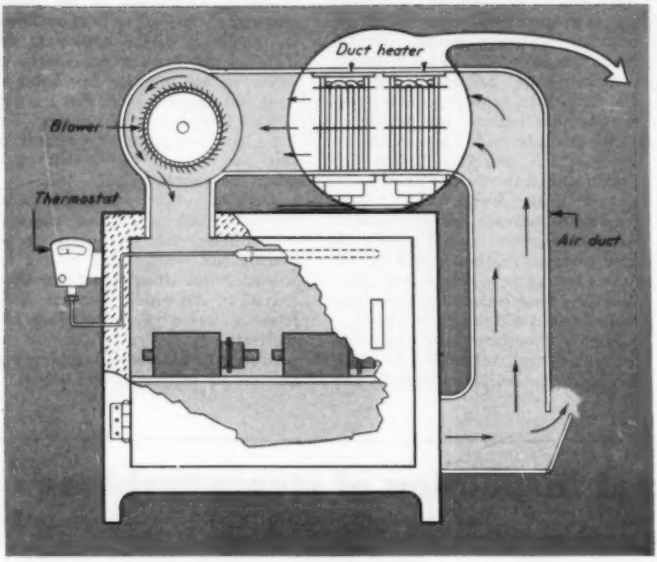
10—Inlet steam strainer should be inspected and all accumulated dirt or sediment removed.

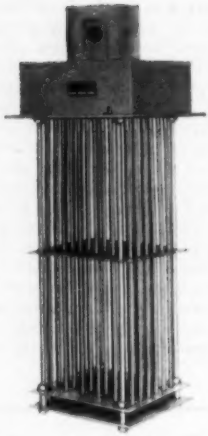
11—Throttle and governing valves should be cleaned and, if necessary, discs and seats should be ground to make sure that they are tight.

12—Valve operating and governing mechanisms should be cleaned, lost motion removed and parts replaced wherever excessive wear is observed.

13—Oil pumps should be inspected for bearing wear and condition of gears and casings. Oil relief valves should be cleaned and reset.

14—Steam joints should be cleaned and steam or water cuts repaired to prevent objectionable leakage.





Electrical units in the ducts are protected from damage and easy to service. Recirculating method maintains even heat, allows better control of zones

Tubular Electric Duct Units . . .

HEAT RECIRCULATING OVENS

FRED PERKINS
The Lanly Company

TUBULAR HEATERS, completely assembled and designed to fit into air ducts are a relatively new heat source for recirculating industrial ovens. Temperatures up to 1000 F are easily achieved and accurately maintained by thermostatic control for core drying, heat treating, annealing and other applications.

The duct heater consists of a number of hairpin shaped tubular elements with inconel sheaths and highly compacted refractory. Wiring terminals, located outside the heat zone, may be connected so that the entire heater or various sections are separately controlled. Standard ratings for complete heater units vary from 6 to 60 kw.

Specially built for an electric motor manufacturer, the small and compact oven illustrated by the schematic diagram is being effectively used for heat-treating arbors. 800 F is required and is reached in three hours with an oven load consisting of 20 arbors, each weighing 25 lb. Total duct heater capacity is 20 kw. The considerably concentrated load is uniformly heated and a unique fan arrangement provides very efficient air circulation.

The oven has been satisfactory both in performance and operating cost.

Another large recirculating oven was built for a West Coast aircraft manufacturer. The problem here was to age harden large numbers of aluminum parts. Close automatic control, uniform temperature and versatility highlight the installation.

The oven, which measures 45 x 21 x 8 ft, may be divided into two separate thermostatically controlled sections by closing a sliding door in the center. Leaving this door open allows use of the over-all length of the oven for larger parts.

Four heating zones comprise the oven, each provided with several heater and fan units. The heaters are sized to give a capacity of 144 kw per zone. The total capacity, 576 kw, is sufficient to heat 10,000 lb of aluminum to maximum operating temperature of 500 F in one hour.

A novel feature is incorporation of temperature indicators at 12 different points inside the oven. Heat at all 12 points can be rapidly checked by operating pushbuttons on the indicating instruments.

A soaking timer provides automatic operation during heat-treating. The heating cycle consists of a rapid uncontrolled temperature rise, and a timed soaking period, after which power is cut off. Working in conjunction with the soaking timer is a second timer so arranged that it will shut off the oven fans a definite period after power to the heaters is cut off.

Each compartment can be set up for identical time-temperature programs, and their operation as units can be staggered so that their heating and cooling occur at opposite intervals.

On completion of the installation the aircraft company's tests showed that at a controller setting of 212 F, the total effect of spread and swing produced a maximum temperature range of 6 F, which may be resolved into a plus or minus 3 F variation, within the region outlined by the indicator thermocouples. At a controller setting of 315 F, the total temperature range was again 6 F within the working zones as before defined.

The tubular electric heater is ideal where hot, dry air is needed as in core drying. It can also be used when intake air is very moist because the seamless inconel tubing resists moisture and corrosion.

Such heaters are fabricated as complete units and can be installed quickly and easily. Bolt holes can be drilled in the flange. Terminals, located outside the heating zone are easily accessible through a removable cover.

REFUSE BURNING IN SPREADER STOKER FIRED FURNACES

Spreader stoker fired steam generators are now being used to burn many types of waste. The furnace designs, feeding methods and combustion principles of these boilers can satisfy the specific requirements of refuse burning systems

WILLIAM S. MAJOR
Project Engineer, Power Dept., Dravo Corp.

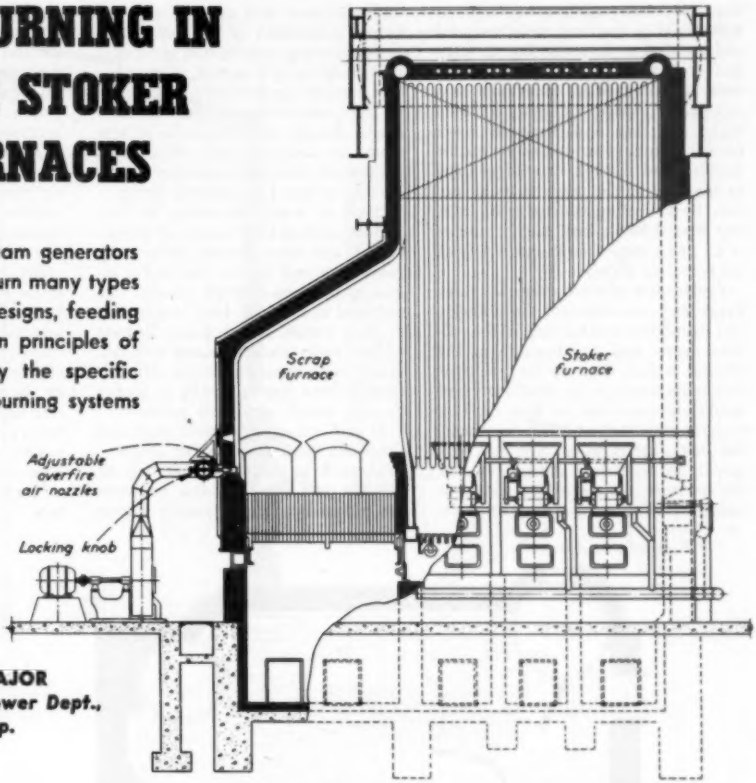


Fig. 1—Dual furnaces provide one convenient arrangement for burning coal and bulk refuse separately in the same boiler

NUMEROUS manufacturing processes produce residual materials having widely varied characteristics. Some of these wastes are worthless or objectionable, creating disposal problems, while others have sufficient value to warrant expenditures for reclamation. Many of them can be burned, and this method has long been employed to dispose of refuse.

With costs of coal, gas and oil increasing, various wastes that have potential value as supplementary or substitute fuel are receiving greater attention. No longer is refuse burning considered primarily a disposal operation. Instead, maximum conversion of the heat in the refuse to useful work is the fundamental objective of most modern waste burning systems.

In the past, much refuse was burned in furnaces of the flat grate Dutch-oven type. Recently, boilers utilizing the combustion principles and modifications of the feeding methods developed for spreader stoker firing have been applied. Different arrangements, using one or two furnaces designed to burn waste singly or in combination with alternate fuels, have greatly increased the efficiency of refuse burning systems.

Waste wood, a typical refuse fuel, varies widely in size, shape and moisture content, depending on the process or source from which it emanates. For example, variations from sander dust to oddly shaped chunks of wood result from sawmill operations. As to the moisture content, green wood may contain up to approximately 50 per cent, while kiln-dried woods carry about 10 per cent. Between these limits are air-dried woods that carry 20 to 25 per cent moisture.

The calorific values of wood are considerably influenced by the presence of resins, gums and other substances, with highly resinous woods having the greatest heat content. Largest variation exists among such woods as long and short-leaf pines, western yellow pine, pinion pine, cedar, juniper, and cypress. On a moisture and resin-free basis, wood has an average thermal value of about 8300 Btu per lb. Table 1. details typical analyses of refuse and wood fuels that are now being burned in spreader furnaces. Refuse coffee, peanut shells, waste leather, scrap felt base floor coverings and tobacco stems are other by-products being burned in such furnaces.

When there is a large quantity of various shapes and sizes of wood refuse, hogging machines are generally employed to give a more uniform product known as "hogged fuel". Material in this form is easier to handle and feed to the furnace and burns more efficiently. In some circumstances, hogging or cutting-up of the refuse may be complicated by the presence of foreign metal that could shatter the shearing blades and create hazardous operation. Conditions of this kind can often be corrected by incorporating metal traps or magnetic separators.

One eastern mill, producing felt base floor covering, found from experience that it was impractical to cut up the scrap materials. However, the economy of burning the refuse as a supplemen-

tary fuel could not be sacrificed. As a result, dual furnaces were designed and installed as shown on Fig. 1. Scrap and coal are burned separately and then the combustion gases join and mix before passing through a common boiler. All sizes and shapes of waste resulting from plant operations can be readily fired through two large doors in the rear of the scrap burning section. By controlling the coal firing rate, any desired boiler load may be carried at all times, even though the supply of refuse varies widely.

Combustion of wood comprises three stages; (a) evaporation of the moisture, (b) distillation and burning of the volatile matter and (c) burning of the residue carbon. One of the principal factors influencing the satisfactory and smokeless execution of this cycle is high moisture content. With dry woods, the first stage is quite brief, followed quickly by distillation and ignition. As the moisture content of the wood increases, ignition becomes more difficult, and additional heat must be supplied before combustion of the fuel can be self-supporting and the heat generating portion of the cycle started. If the moisture content approximates 65 per cent or more, combustion can only be maintained through the application of heat from an auxiliary fuel. Mechanical presses are sometimes employed for reduction of moisture prior to firing.

Type of wood, percentage of bark and/or sawdust and amount of foreign matter are other factors influencing combustion and furnace design. For instance, the non-resinous woods, like redwood or hemlock, burn slower than resinous woods, such as pines. Because of this, faster burning woods with relatively high moisture content will frequently burn just as rapidly as slower burning woods with little moisture.

If logs are dragged over land and floated in fresh or salt water, contaminants such as dirt, sand, salt, marine growths and other foreign materials are picked up that frequently impair combustion. Slagging of boiler tubes, greater clinker formation, increased fly ash and reduced boiler capacity may accompany the burning of such woods. To overcome these problems, many woods are washed before they are processed and the refuse burned.

In the design of refuse burning furnaces employing spreader stokers, there are three types of grates available for consideration; (a) stationary, (b) dumping and (c) traveling continuous ash discharge. Stationary grates are generally confined to the smallest units or for conditions of extremely low load factor. Dumping grates are frequently selected for steaming capacities of about 50,000 lb per hr and even up to 100,000 lb per hr, if little or no coal is to be burned. Above these capacities, traveling grates are generally utilized because lower operating labor accompanies continuous ash discharge and efficiencies are improved.

Waste feeding methods include rotors with distributors and/or chutes

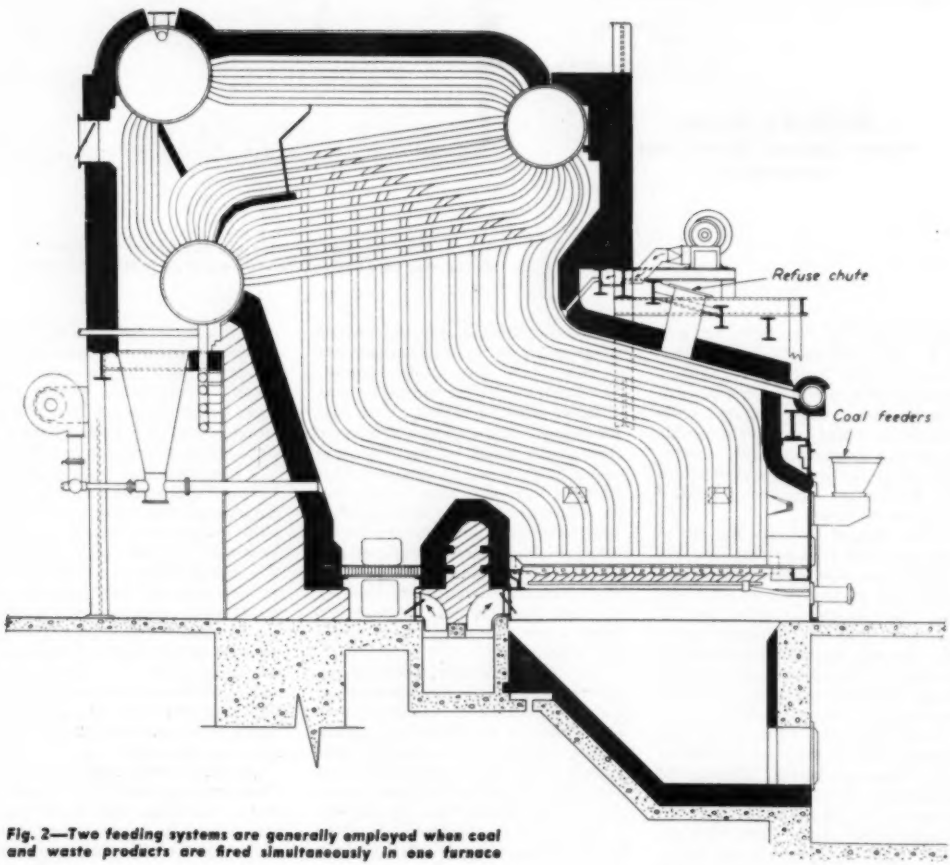


Fig. 2—Two feeding systems are generally employed when coal and waste products are fired simultaneously in one furnace

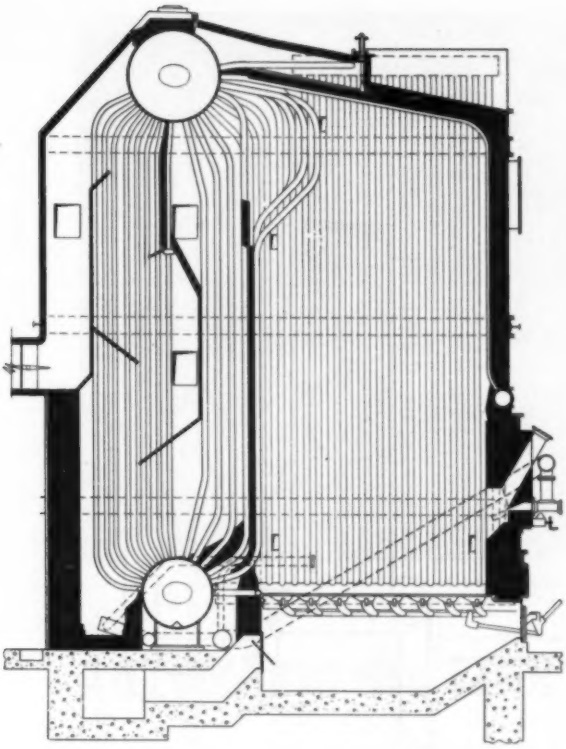


Fig. 3—This pneumatic spreader stoker fired unit was designed specifically for burning pine chips

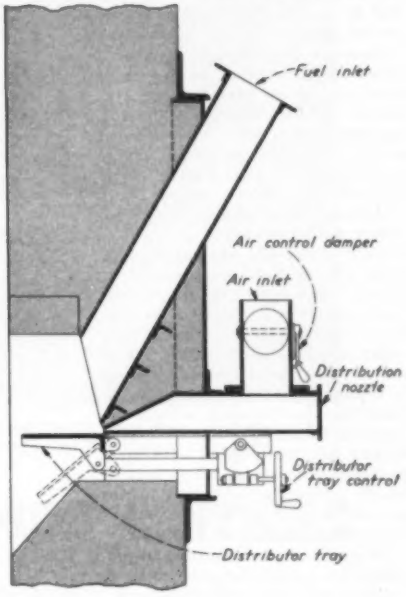


Fig. 4—Distribution of hogged fuels is controlled by regulating air flow and tray angle as required

that deliver the refuse through the wall substantially above the grate level. In some cases, both the feeders and the chutes are equipped with air jets to facilitate uniform distribution over the entire grate. Generally, refuse delivered by rotors is limited to sizes that will pass through a 2 in. mesh screen and any larger material is fed by chutes.

Due to the relative densities of coal and a refuse like wood, feeding a mixture of the two fuels with the same rotor would be impractical. A feeder speed that would yield uniform fuel distribution for one of the fuels would result in maldistribution of the other fuel. Fig. 2 shows a typical installation in a Wisconsin paper mill where wet bark and coal are simultaneously fed to the same furnace. The wet bark enters the furnace through refuse spouts in the arch, and coal is introduced in conventional fashion by rotors.

Fig. 3 shows a 30,000 lb per hr pneumatic spreader stoker fired steam generator designed to burn pine chips at a southern mill. This type of distribution, as shown in Fig. 4, was developed specifically to handle waste products like bagasse, shredded bark and hogged wood. The fuel is fed through a chute to a distributor tray where it is caught in a jet of air and dispersed over the grate. By adjusting the positions of the air control damper and/or the distributor tray, variations in fuel feed and spread are obtained. The fan that actuates the distributor nozzle is selected for about 20 per cent of the theoretical air requirements at pressures of 8 to 20 in. wg depending on furnace size and refuse weight. Experience indicates the feeding chutes should slope at approximately 60 deg to assure continuous flow, particularly for fibrous waste fuels that have a high moisture content.

Table 2 shows a summary of results obtained in a Louisiana mill where bagasse is burned in a pneumatic spreader stoker fired boiler. Testing was by the heat balance method and radiation losses were based on standards established by the American Boiler and Affiliated Industries.

During the past few years, refuse burning furnaces have been installed employing high-set feeding rotors. Fig. 5 shows a sectional view of one steam generator where the refuse feeders are set 17 ft above the traveling grate. This location is approximately 18 ft below the entrance to the superheater section. Below the rotors are seven rows of tangential nozzles, which deliver overfire air at a temperature of about 550 F.

TABLE 1—ANALYSIS OF TYPICAL REFUSE AND WOOD FUELS IN PER CENT BY WEIGHT

	Corn cobs	Coconut shells	Bagasse	Western hemlock	Pine sawdust	Spent tanbark
Carbon	51.3	53.1	43.5	52.4	51.8	52.0
Hydrogen	5.4	5.4	5.5	5.8	6.3	6.5
Oxygen	37.3	40.5	48.0	41.4	41.3	40.0
Nitrogen	.9	.2	.3	.1	.1	—
Ash	3.7	.7	2.7	2.2	.5	1.5
Sulfur	1.4	.1	—	.1	—	—
	100.0	100.0	100.0	100.0	100.0	100.0
Btu per lb—dry basis	8675	8932	8400	8620	9130	9950

Since the directional rotation of air flow is reversed in alternate rows, a pronounced swirling effect has been created. This turbulence in an atmosphere of hot air is conducive to flash drying and rapid combustion. Overfire jets were also installed under the rear arch and in the upper portion of the rear wall to periodically supply additional air for smoke control.

As to performance, this unit has operated at an output of 160,000 lb of steam per hr for periods of three to four hr. At this steaming rate, the furnace heat release was 38,000 Btu per cu ft per hr, and the refuse burning rate referred to the grate area was 1,250,000 Btu per sq ft per hr.

Although heat releases of approximately 35,000 Btu per hr per cu ft of furnace volume will give acceptable results, improved efficiency and lower fly ash concentration accompanies release rates below 25,000 Btu. These release rates are based on the use of fully water-cooled furnaces. In this type of unit, a minimum of furnace refractory is required, and lower excess air volumes may be employed without objectionable slagging or abnormal maintenance. Minimum furnace refractory is particularly beneficial when burning woods containing salts and marine growths, since these foreign substances attack bare refractory walls.

Most refuse furnaces incorporate provisions for introducing overfire air to improve combustion and control smoke. Maximum benefits are obtained when the air is introduced at pressures sufficiently high to impart turbulence to the furnace gases. Generally, these systems provide approximately 15 to 25 per cent of the total air supply, but some units use as much as 40 to 50 per cent overfire air. In all cases, sufficient air must be fed through the grates to prevent clinker formation and maintain the ash in a granular condition.

When burning refuse fuels that mat together there is unequal air flow through the grate and resultant stratification of the furnace gases. For this condition, overfire air is effective in breaking up the rich gas streams and providing air for proper combustion.

There are two principal reasons for the increased adaption of spreader stoker fired furnaces to refuse burning systems. In the first place, the method of feeding is conducive to suspension drying and/or burning of the finer sizes. Secondly, the furnace configuration lends itself to auxiliary firing with either coal, gas or oil. With dual fuels, any desired boiler load can be maintained at all times even though the quantity, moisture content and heating value of the refuse varies quite widely.

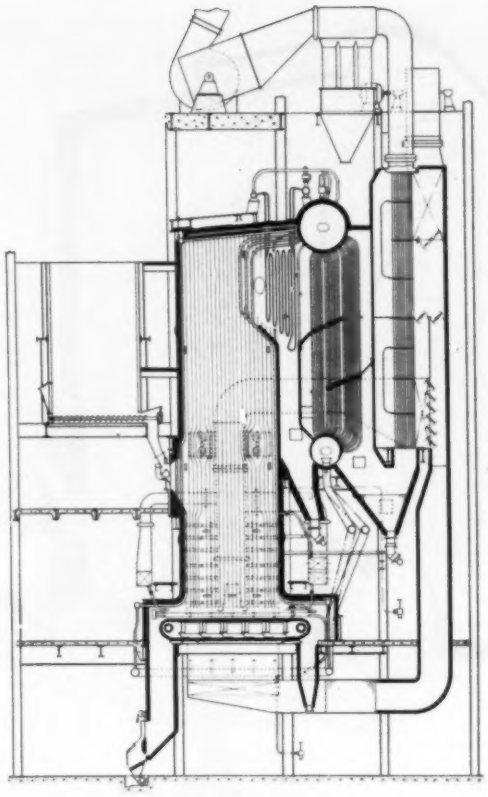


Fig. 5—Hot air jets set below the feeders help produce furnace turbulence that facilitates suspension burning

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TABLE 2—SUMMARY OF PNEUMATIC SPREADER STOKER TESTS WITH BAGASSE

Developed boiler horsepower	**548**	**778**
Heat balance in per cent		
Loss due to moisture in bagasse	14.2	14.8
Loss due to hydrogen in bagasse	8.8	8.8
Loss due to moisture in air	.3	.3
Dry gas loss	11.5	12.6
Carbon loss in ash pit	.1	.1
Carbon loss in fly ash	1.4	1.4
Radiation loss	1.8	1.2
Unaccounted for loss	1.5	1.5
Total losses	39.6	40.7
Combined boiler and furnace efficiency	60.4	59.3
Per cent CO_2 in boiler exit gases	14.4	12.9
Per cent O_2 in boiler exit gases	5.4	6.9
Boiler exit gas temperature — Deg F	543	553
Per cent combustible in ash pit refuse	1.7	1.4
Per cent combustible in fly ash	12.0	12.0
Grate heat release—Btu per sq ft per hr	271,000	394,000

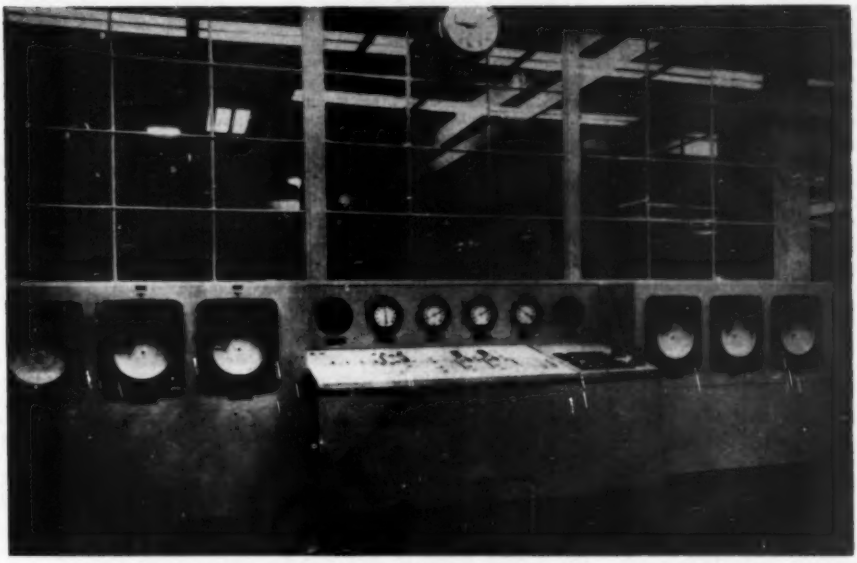


Fig. 1—Central control position in an engine driven pump station. Only those variables which can be controlled from this position justify indicating or recording systems here

AUTOMATIC OIL LINE PUMP CONTROLS

Pipelines are necessarily progressive in development of automatic controls for pumps. Here * are coordinative and protective circuits and devices for diesel, gas engine and electric motor driven pumps

C. B. LESTER, *Chief Engineer, Mid-Valley Pipeline Company*

CENTRALIZED CONTROL as used by Mid-Valley Pipeline Company is described here, not because the system is new or unique in any great degree, but because it represents a common approach to the problem in both electric and engine driven pump stations.

The system consists of 13 pump stations, some still under construction. Four are driven by gas diesels, four by crude burning diesels, and five by two-pole electric motors. Selection of prime movers was made on a strictly economic basis, and are grouped generally as follows: On the south portion of the line, gas was too economical for motors to compete; in the central portion, gas could not compete with low power rates; while on the northern end of the line, where gas was not available in sufficient quantity and electric rates were high, straight diesels, running on cleaned crude, were most economical.

Had it been possible to obtain delivery on a certain type and rating of gas turbine, it would have been used in one of the gas diesel stations. Though not sufficiently more economical to justify its use over proven prime movers, the contribution to industry knowledge would be well worth while.

The ideal control system for an oil line pump station should:

1. Put the station on stream as quickly as possible.
2. Keep the station on stream at the highest efficiency throughout a wide range of throughput variations.
3. Prevent the station's actions from damaging station, line or operating personnel.
4. All control features should be consistent with the economics involved in the problem.

The term "control system" can best be discussed if it is subdivided into its components, *instrumentation* and *control*. Instrumentation as used herein will be the reading of parameters either by human means or automatically, and control will be the effecting of desired operations through direct action of the operating personnel or indirect action resulting from signals developed in the instruments.

In setting up instrumentation requirements of a station it is convenient to divide instruments into three groups: (a) basic, (b) auxiliary and (c) supplemental.

Basic instruments read three station parameters; suction, discharge and flow, and are the same without regard to type of prime mover.

Auxiliary instruments read unit parameters and, with the associated control devices and in conjuction with basic instruments, prevent damage to station

***Abstracted from the paper "Centralized Control in Oil Line Pump Stations" presented at the AIEE Winter Meeting.**

operating personnel or line. Pump functions read are suction and discharge, and bearing and case temperature.

With electric prime movers, motor bearing temperature, motor winding temperature, and motor voltage and current are also included in the auxiliary group. Where engine prime movers are used, engine jacket water temperature, speed increaser bearing temperature, engine lube oil pressure, and engine speed are read.

Supplemental instruments encompass the reading of all other desirable parameters. Typical supplemental parameters read in an electric station are demand and reactive power. In an engine driven station, lube oil temperature, supply gas pressure, and manifold pressure are among those read.

Instrumentation Grouping

1. Basic items should be read centrally and recorded.
2. Auxiliary items should be read centrally, and may or may not be recorded.
3. Supplemental items are usually not read centrally, or recorded.

In determining whether or not to record a parameter, it is generally only necessary to consider if the time history of a parameter contributes to economical operation. Thus, history of station suction pressure, discharge pressure, and flow rate is valuable; the record is a needed tool in determining the manner in which the controls handle a transient condition.

Auxiliary items, for instance, motor winding temperature, taken continuously, are not of too much value inasmuch as the temperatures vary slowly with age for a given load, or, in the case of a burnout, exceedingly fast. The time history of such a parameter may be valuable if read daily; value is not increased if read continuously. Conversely, pump case temperatures, motor bearing temperatures, etc. have valuable time histories and should be recorded.

Variables read but not recorded may be gaged, indicated, alarmed, or only made available to the controls as actuating signals. Reasoning behind recording of parameters can be extended to cover these cases.

If mid-position value of a parameter is valuable to the operating personnel, that variable should be read with a gage. Engine speed and pump nozzle pressures are good examples.

Parameters normally either "on" or "off" may be merely indicated. A red and a green light, for instance, can indicate whether a valve is open or closed; are usually arranged so that both are lighted when the valve is in mid-travel. Parameters considered only when abnormal may be indicated by warning lights, as with motor overcurrent.

Good examples of variables alarmed as backing-up indications of those read in another manner are pump suction and discharge pressures. Though read with gages, the abnormal condition usually disappears when the automatic shut-down controls take over. Therefore, it is convenient to have an alarm light to denote the condition existing prior to the time of shutdown.

Parameters fed directly into the controls include position of the motor air duct flutter switch, which closes when sufficient air is being supplied. This is useless to the station operators, so the signal from the instrument reading is fed directly into the sequence control.

Centralized Reading

Parameters read but not recorded or indicated are excluded from centralized

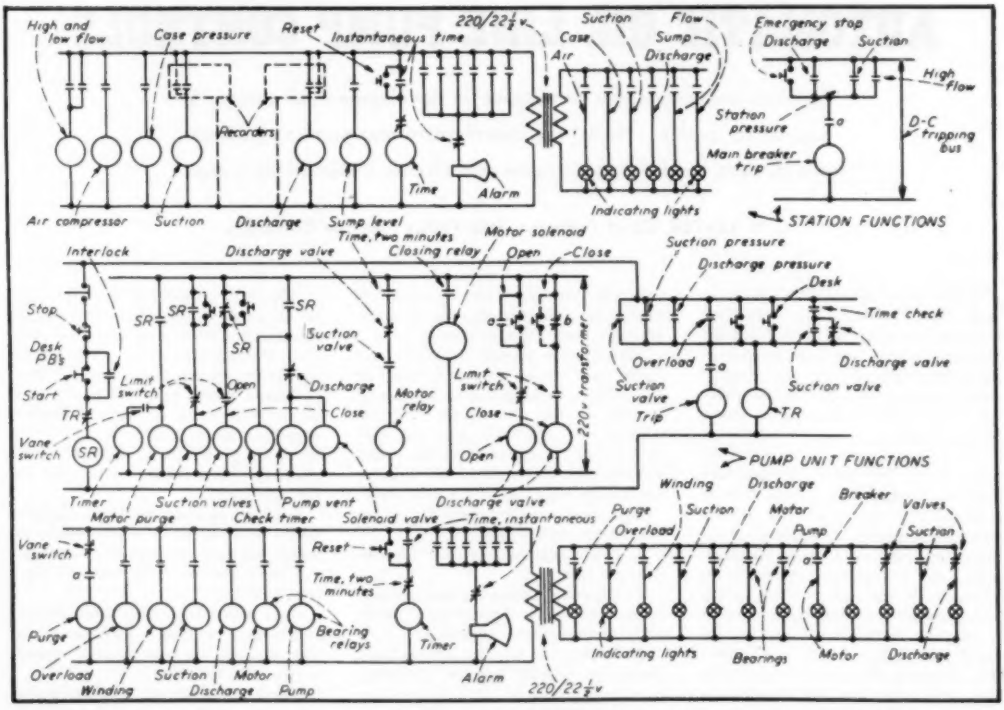


Fig. 2—The circuit for automatic control system relays is shown in the elementary schematic diagram for an electric motor driven pump station. Control functions are grouped according to their importance and their ability to effect starting and protective operations and are located as necessary for either local operations or centralized control

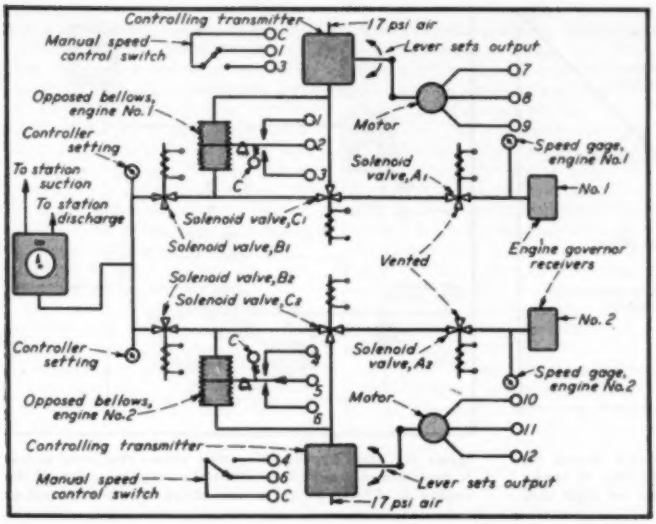


Fig. 3—The governor control puts two or more diesel engine pumps in operation gradually and in unison; or allows putting a reserve engine on line as needed. System in Fig. 5 is used to avoid critical speeds

reading because it implies reading by a human agency.

Tests to determine if any variable should be read centrally are: (a) Is value of a parameter useful to the operating personnel while at the centralized control position? (b) Is centralized presentation of the value sufficiently useful to support the cost? Obviously, strainer inlet and outlet pressures do not justify cost of instrument lines and fittings needed for remote reading.

Controller Types

Control, as stated previously, is considered herein as the effecting of desired operations either from actions initiated by the operating personnel or from actions initiated by instruments.

Controllers may be divided into three classes for consideration herein:

1. *On-off controllers* are self-explanatory. A pushbutton, or relay, is an example.

2. *Variable controllers* are here defined as manual controllers which may be set intermittently to various positions within their operating range. A hand-operated valve, for instance, on a water system can be set in any position, yet it is not varied except when the operating personnel think that a change is desirable or necessary.

3. *A throttling controller* is one which automatically and continuously strives to keep the controlled variable on the control point. The jacket water temperature controller on an engine, or the main line throttle valve at an electric station, are examples.

In summary, an on-off controller is a two-position controller with no feedback; a variable controller is a throttling controller with the feedback loop closed intermittently through a human agency; a throttling controller is continuously variable within its range and always operates within a closed feedback loop.

When should ability to set a controller, or ability to initiate action of a controller (in the case of those actuated by the operating personnel) be available at the control position? Within the scope of this paper, if it is mandatory to be able to set the control point or initiate action of any controlled variable that materially and regularly affects the condition read by the basic group instruments, ability to set the control point or initiate action should be available at the central control point. Conversely, if a parameter is not read centrally, it should not be controlled from the centralized control position.

Note that the term "centralized control" applies only to ability to set the control point on controllers actuated by signals from the instruments.

Within the framework of the above rules, a designer is free to come and go as he pleases, especially in the case of engine-driven stations. In Mid-Valley's engine stations, for instance, auxiliary and supplemental instruments are subcentralized. The parameters are available on engine control stands mounted beside each engine. Certain on-off and throttling controllers are duplicated in the control room and on the engine control stands so that the engines can be operated from either position during normal conditions.

New Control Items

Two items apparently have not been used before in pipeline stations. The first, the "Governor Control" used in the diesel stations is the first attempt to put multi-unit diesel stations on stream automatically without shock, and

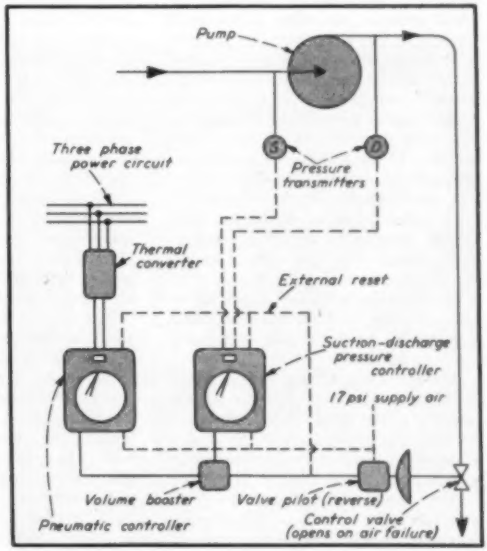
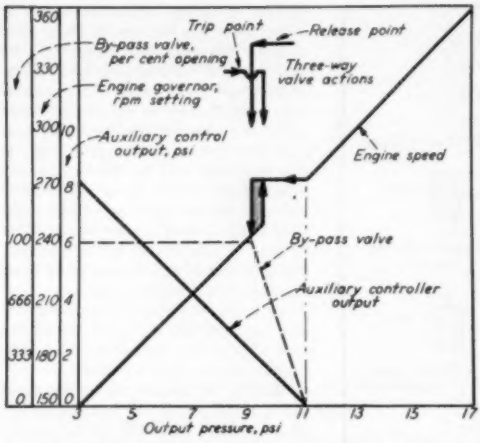


Fig. 4—Load limit controller is used on electric motor driven pumps for limiting overload conditions during line packing operations. Output of the thermal converter controls valve and therefore motor load during the high demand periods but in normal operation it becomes inactive



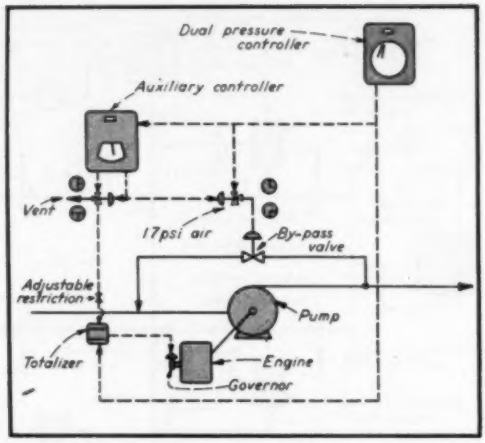


Fig. 5—The discontinuous function controller forces the engines through the critical speed range rapidly as shown by the graph at the left. Control diagram at right also shows the pump bypass valve that allows the pump output to meet demands anywhere within the range even though the engine is driving it at speeds above the critical values

Shell Products Pipeline Division's well-known basic design has been modified to produce this effect. The second item, the "Load Limit Controller" is an attempt to furnish a third signal for electric station control systems to limit demand during line packing conditions.

Governor Control

Operation of the governor control can best be explained by the diagram of the pneumatic circuits, Fig. 3. For simplicity, electrical connections are not shown but are described where pertinent to the operation.

Assume an engine is running on automatic speed control. Output of the dual pressure controller is connected directly to the engine governor receiver, and the engine speed is under control of the dual pressure controller under all normal conditions. If a shutdown signal reaches solenoid valve *A*, governor air is dumped and the engine goes to idle. If the abnormal variable goes through the governor dump point very fast, an irrevocable shutdown is effected. This action is caused by having three on-off contacts on the basic group of instruments. The first contact sounds an alarm, continuing increase in deviation from the set point dumps air on the governor, and further continuing increase causes the engine fuel dump valve to operate.

To start a second engine, it is rolled on air and brought up to a pre-set idle speed until the *Cold Engine* conditions set into the control stand no longer exist. The second engine is then switched to automatic control.

Since the output from the dual pressure controller now feeds two engines, it tries to drop because of the increased volume it measures. Immediately solenoid valves C_1 and C_2 tie the governors into the controlling transmitter. Then because an unbalance exists between the dual pressure controller outputs (that of controller transmitter of engine No. 1 being too high, and that of engine No. 2 being too low), the opposed bellows actuate electrical contacts which slowly move the set point of the controller transmitters by rotating the reversible motors until the opposed bellows are in balance. Then both engines come under the control of the dual pressure controller as solenoids C_1 and C_2 go back to normal.

The system can be used for any number of engines. Starting sequence is:

After the first engine is rolled on air and is firing, it comes up to a normal idle speed. If the engine is cold, it continues to idle until the pre-set *Cold Engine* conditions no longer exist and the signal light disappears. An *Auto-Manual* switch is turned to *Automatic*, after which the engine comes up to its maximum pre-set operating speed, or to the maximum speed at which pre-set maximum discharge or minimum suction pressure conditions permit. The pull-in time can be set for any reasonable period, usually 3 min.

The second engine is rolled on air, and idles until warm. Then the *Auto-Manual* switch for this engine is turned to *Automatic*, at which time engine No. 1 starts slowing down, and engine No. 2 starts picking up. This continues, holding line conditions constant, until both engines are operating at the same speed, when both go up in speed together until they reach the pre-set condition in engine speed, station suction, or station discharge.

The third engine is started in a similar manner, the first two engines slowing down until all three engines are operating at the same speed, after which all three engines go to limiting speed.

After all three engines are on stream normally, their speeds are kept the same and varied simultaneously to suit line conditions set in the special dual pressure controller. Thus, if the engines are operating into a slack line, their speed is kept as low as possible without tripping the station suction pressure low limit control. When operating into a packed line, speed is kept as high as possible without tripping the station discharge pressure high limit control. During all intermediate conditions, the engines operate up to the limit stops set into the engine governors.

Load Limit Controller

The load limit controller feeds a third variable into the two-variable controller used for positioning the throttle valve in the electric stations. Normally this controller holds a maximum discharge pressure or a minimum suction pressure, depending on which happens to be the limiting variable at the time. During starting, when operating into a slack line, however, these parameters read falsely insofar as the valve is concerned because the settings in the controller are based on normal, packed line conditions.

This device does two things: (a) it saves the motor windings from overload currents, and (b) it holds down demand charges to a pre-set maximum, while permitting the station to get on stream as quickly as possible during starting conditions without damaging itself. It was calculated that this device

will recover its cost after taxes in less than 6 months with normal starting.

Electric stations commonly control from suction or discharge pressure, whichever happens to be limiting during a particular instant. The system, Fig. 4, is based on using a third variable which can override the other two, deriving a control signal from the station power lines proportional to power by means of the thermal converter.

The control system is predicated on the design that the valve is positioned by the variable supplying the least amount of air to the operator.

From the drawing it may be seen that, if under normal conditions, either the suction or discharge pressure transmitter units cause that controller to have a lower air output than the thermal converter controller, the volume booster is acting as 1:1 relay, using the output from the converter controller as supply air. Then air pressure to the valve will be precisely that of the limiting signal from the controller sensing station suction and discharge.

Conversely, if the lower output pressure comes from the thermal converter controller, the volume booster is merely held open by the higher output from the dual-pressure controller. The converter controller output goes directly to the control valve and determines motor power. External reset connections are necessary because the reset air pressure of a controller is the same as the valve motor actuating pressure.

Under normal operating conditions, power requirements will not exceed the set point of the thermal converter controller and the station control is station suction and discharge pressure.

Under starting conditions, operating into a slack line, the power requirements can exceed those limited by either station suction or discharge pressure. The signal from the thermal converter takes over and holds the demand to the preset maximum, gradually letting the discharge pressure come up under constant power input conditions until the power required is less than the setting of the thermal converter controller, after which it is inactive.

A similar system can be easily arranged for diesel units to prevent overloading engines while bringing them on stream in the minimum time during starting operations by feeding a limiting signal developed from the flowmeter into the system exactly as in the power signal in the unit described here.

Discontinuous Function

The governor control will set engine speed in the critical range if the line requirements call for such operation. To eliminate this dangerous condition, the discontinuous function controller, Fig. 5, was devised.

Output pressure from the dual-pressure controller is connected through a totalizing relay to the engine governors. When the engine speed as measured by the auxiliary controller is below or above the critical zone, the totalizing relay merely repeats the output pressure of the dual pressure controller to the governor.

For a critical range of 250-275 rpm, the auxiliary controller is set so that its output pressure will be 1.6 psi at 250 rpm. Simultaneously, the three way valve connects the by-pass valve diaphragm to the dual pressure controller, applying 9.6 psi to it and opening it immediately to about 75 per cent capacity, corresponding to the increase in engine speed.

As the load increases, output of the dual pressure controller increases, thereby closing the by-pass valve. Because of the totalizer, the engine speed depends on the sum of the two controller output pressures, and since the former increases exactly as the latter decreases, engine speed remains constant.

When the dual pressure controller output has reached 11.2 psi, the control valve is closed, output from the auxiliary controller is zero, and further increase from the dual pressure controller will cause an increase in engine speed. On reductions in speed, essentially the reverse actions take place.

The gap between the three way valve trip point and release point is necessary to guard against jumping engine speed up and down when system load requires operation close to 250 rpm.

UNREELING CABLES FROM STATIONARY SPOOLS

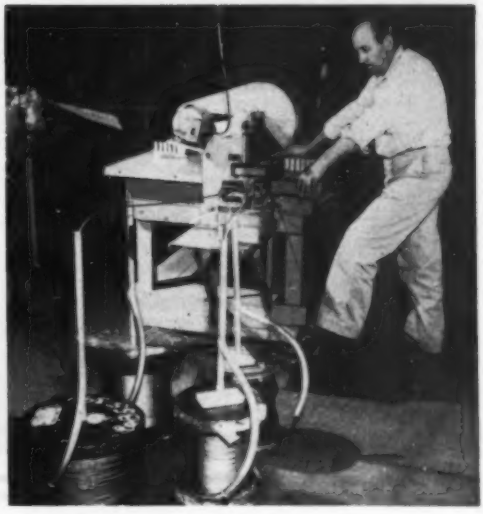
● By making a cable reel act like a spinning, or slip cast, reel for fishing, a cable feeding assembly made of two pieces of welded tube has eliminated the need for the large wooden racks previously used to hold the spools of cable at Texas Engineering and Manufacturing Company, Inc.

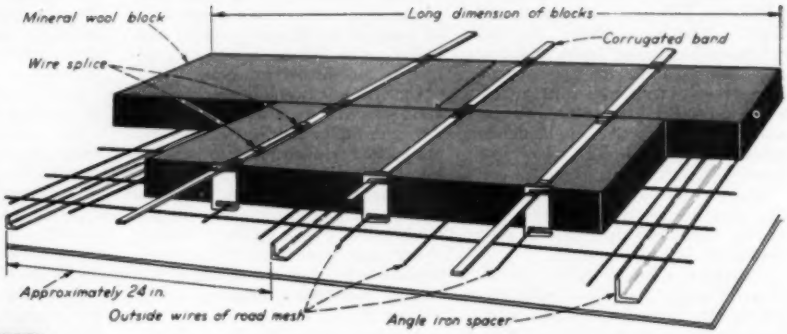
Developed by K. W. Goggans, an employee in the tubing and cables department, the device consists of a straight piece of tubing, with one end flared, to which is welded a second piece of tubing bent in the form of a modified semi-spiral, as illustrated in the photograph. The open end of the curved tube likewise is flared.

In use, the spool of cable is placed on end and the unflared end of the straight tube is inserted in the axle hole. The cable then is threaded through the curved tube and out through the top of the straight tube. A pull on the cable causes the assembly to revolve around the spool, automatically unreeling the cable and feeding it out as required.

The device not only eliminates need for the racks and time and energy required to load the heavy spools onto them, but it also permits faster unreeling of the cable. This is particularly true in the case of large reels where it was necessary to roll the spool in order to unwind cable with the old type racks.

Other advantages uncovered for the new device are better housekeeping and elimination of a safety hazard.



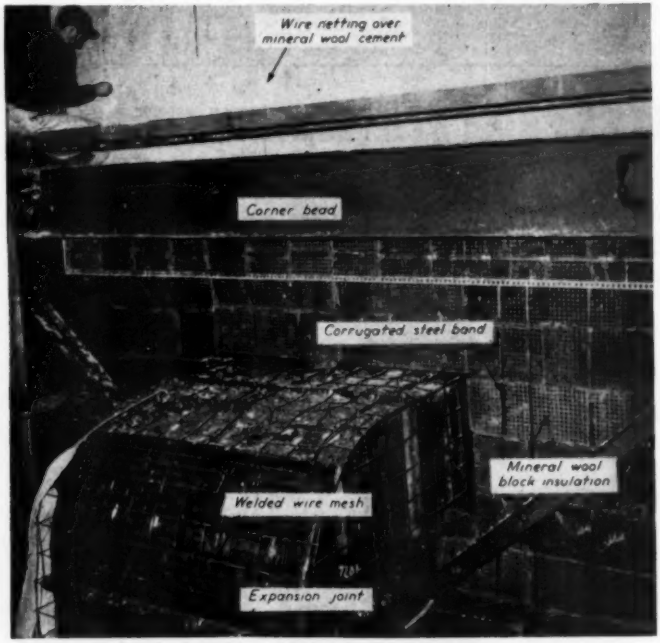


A wire mesh foundation, that is elevated above ribs, expansion joints, flanges and stiffeners, is employed to support the mineral wool blocks in the spaced method of applying duct insulation

SPACED DUCT INSULATION

An application technique has been developed that employs air space between high temperature ducts and their insulation. The smooth, unbroken surface that results provides an excellent thermal barrier

RICHARD L. DAVIS, Secretary, Industrial Mineral Wool Institute



Various stages in the application of spaced mineral wool insulation to a vertical duct are illustrated by this installation photograph

POWER plants generally install thermal insulation to cover heated sheet metal ducts. Conveying large volumes of high-temperature air and gases, the ducts are insulated to save fuel, reduce radiation losses, prevent increased air temperature in the plant and improve employee safety. Whatever the specific reason duct insulation is applied, plant management anticipates and should receive substantial savings in the form of lower operating costs.

Regardless of dollar importance, some plant engineers and operating managers concern themselves only with specifying the insulating material. Others feel they need go no further than "apply 2½ in. of insulation on secondary air duct." An important consideration often neglected by operating management is the method of application, how the insulation is installed, secured and finished. Efficient insulating performance, good appearance and long useful life with low maintenance depends on the quality and suitability of both the insulation and application technique employed during erection.

Insulation contractors and manufacturers individually and collectively have developed application techniques specifically designed for optimum performance with an eye to economy of installation and maintenance. A particular method of application is selected on the basis of (a) temperature of the air or gas in the duct, (b) whether the duct is indoors or outdoors, (c) orientation of the duct—vertical, horizontal or inclined, (d) location in relation to heavy equipment and ease of accessibility and (e) size and shape of the duct. Duct insulation is specified for low thermal conductivity, good structural characteristics, high-temperature limit and ease of application.

The spaced method has been found to be one of the most versatile, dependable and effective application techniques developed for insulating high-temperature gas and air ducts in indus-

try. Good appearance and a tight heat barrier are provided in the smooth, unbroken insulation surface that encloses ribs, flanges and stiffeners projecting from the duct. Because the insulation is not applied directly to the duct surface, less special expansion joint provisions are necessary to prevent the occurrence of cracks. Four basic materials used in the spaced method for applying duct insulation are: (a) 6 x 6 in. wire mesh, (b) block insulation, (c) corrugated steel bands and (d) special punched steel clips. A layer of wire mesh is the foundation material, and the corrugated bands and punched steel clips are the securing members. Mineral wool block, usually in 12 x 36 in. sections, is a common type of insulation.

After blocks have been secured to the duct, a finish is necessary. The various finishing materials and installation techniques detailed in Commercial Standard CS117-49, "Mineral Wool Insulation For Heated Industrial Equipment", can be employed for spaced insulation methods as well as other application procedures. These finishing methods are divided into two categories: (a) insulation "located indoors and not exposed to moisture or abrasion" and (b) "located outdoors or exposed to moisture and abrasion."

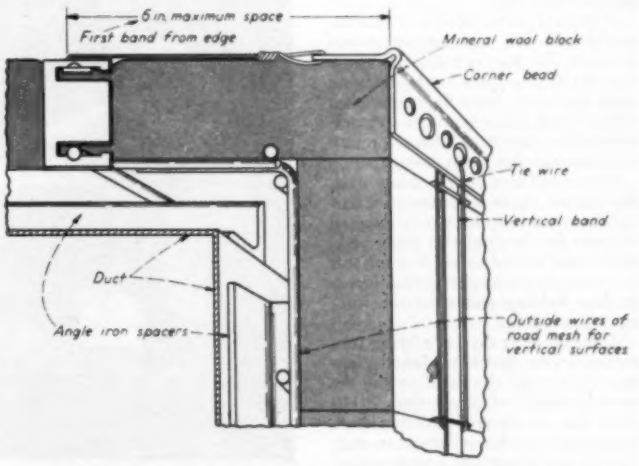
The 6 x 6 in. road mesh is stretched over existing ribs, flanges and stiffeners and tack-welded on approximately 24 in. centers over the duct. If there are insufficient ribs or stiffeners to allow tack-welding of the wire mesh to projecting members at 2 ft intervals, additional angle iron spacers or studs should be welded to the ducts. At splices, the mesh sections should overlap so that the wire runs in straight unbroken lines in both directions. To standardize the securing members, the outside wires of the road mesh should all run in the same direction on a given surface. Outside wires are usually installed vertically on vertical or inclined surfaces and are placed parallel with the longest dimension of horizontal surfaces. The mesh is cut to fit around pipes, hatch openings and protruding connections. Cut wires can be bent down and welded to the duct surface at openings such as access doors.

In addition to providing the extra benefit of good appearance, the flat, unbroken surface of the road mesh foundation permits the installation of large sized insulating blocks with minimum cutting and shaping. As a result, considerable application time is saved and there are fewer gaps at edges and corners of the insulation.

Spaced insulation is employed on all high-temperature ducts at the 120,000 kw Barbadoes Island generating station of the Philadelphia Electric Co. Here the wire mesh was welded to expansion joints both on the top and sides of a by-pass duct, and the outside wires are vertical on all surfaces. Sections of wire mesh meeting at the edges of the duct were carefully welded and clipped to provide a smooth intersection.

After the mesh foundation has been installed, the gaps around flush openings are sealed with miter-cut sections of mineral wool blocks wired to the bent road mesh. Thickness of the insulation to be applied over the spaced framework depends on duct surface temperature. Commercial Standard CS-117-49 recommends minimum insulation thicknesses from 1 in. at temperatures less than 200 F to 3 in. for duct temperatures as high as 700 F. Recommendations call for the mineral wool blocks to be applied in two layers for temperatures above 700 F where more than 3 in. of insulation is required. Because most air and gas ducts operate at

When ducts are smooth, support for the road mesh can be provided by welding equal length studs spaced on 24 in. centers to all surfaces



The application of plasterer's corner bead to outside intersections helps insure tight joints and affords protection for the insulation

temperatures less than 700 F, the insulation is usually applied in a single layer.

Block sections are applied in parallel rows, starting from the bottom on vertical and inclined duct surfaces. The insulation is secured to the road mesh by ¾ in. wide corrugated steel bands, which are held in place by specially designed punched steel clips. These steel bands are installed at 12 in. intervals parallel to and directly over every other row of outside wires. Punched clips are snapped over the outside wires and the steel bands between each row.

For the specified thickness of insulation, the size of the steel clip is selected so that it will slightly pinch the insulation when snapped in place. Since the corrugated bands have sufficient stiffness, each block in subsequent rows of insulation is placed against the top edge of the previous row between the road mesh and the extension of the band. On vertical and inclined surfaces temporary attachment is not necessary before another clip is snapped in place on the other edge of the insulation to secure the block permanently. Each block of insulation is individually attached to the wire mesh.

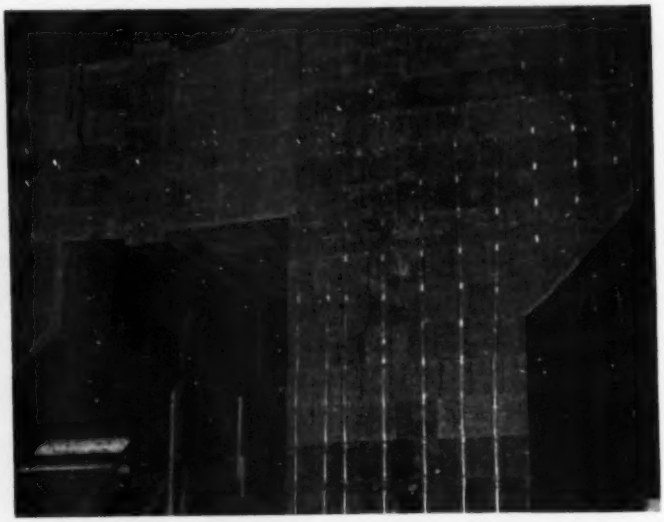
In one instance, the side of a duct was completely covered with two layers of 2 in. thick mineral wool blocks. Each block—placed so that its 36 in. (long) dimension is horizontal—was secured vertically by three corrugated steel bands. The steel clips were then installed at 12 in. intervals, a spacing found most satisfactory. Whether in a single layer or two layers, all sections of insulation must be staggered so as not to line up corners and edges. The blocks are easily cut with a knife or saw to provide special shapes for duct connections and turns.

Plasterer's corner bead is usually installed on edges and outside corners of ducts. The bead is held by tie wires attached to corrugated bands spaced no more than 6 in. from the intersection. Corner bead helps to insure tightness of outside joints in addition to protecting the insulation from damage.

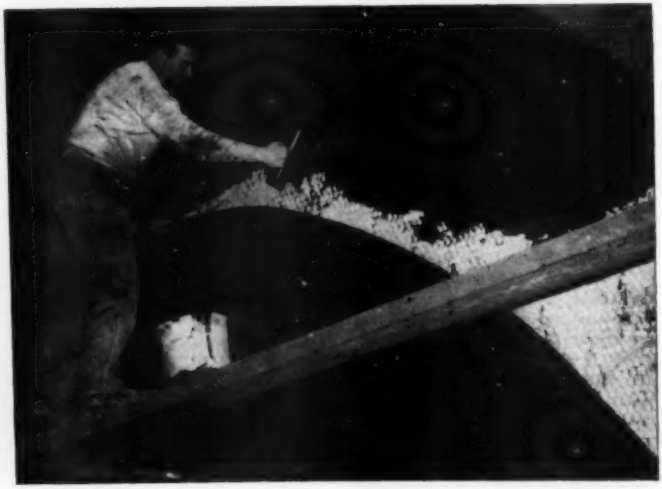
One installation of an outdoor duct, feeding fly ash to collectors on a roof at temperatures up to 300 F, required supports for the insulation framework. Studs were welded to all duct surfaces on 24 in. centers to provide sufficiently close welding points for the wire-mesh foundation.

A forced draft duct at a boiler connection in the Barbadoes Island plant was completely insulated with the spaced method of application. The 600 F duct was covered with two layers of mineral wool block insulation, each layer 1½ in. thick. On a large expansion joint near the floor on the vertical section, the blocks were built up and the steel bands installed horizontally.

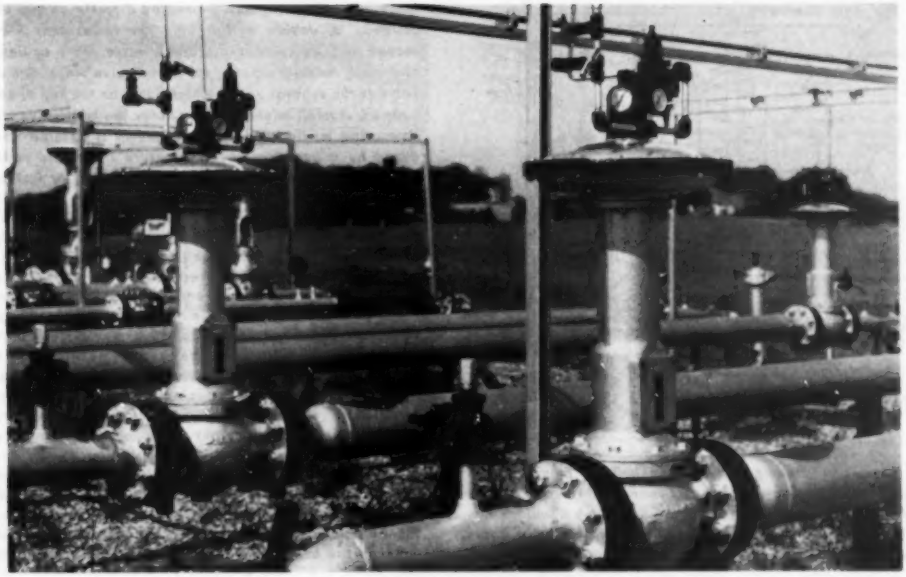
Mineral wool cement and finishing cement is applied to cover the block insulation. Whether indoors or outdoors, the duct insulation may be finished with asphalt weatherproof mastic (dry thickness, ⅛ in.) troweled over 1 in. galvanized wire netting that has been stretched tightly over the surface and secured in place with 16 gage soft iron wire. As an alternate finish for indoor locations, six or eight ounce canvas may be sewed or pasted evenly in place over the cement. When pasted, all wrinkles must be smoothed out of the canvas before drying. The stitches on sewn canvas should be spaced no more than ⅓ in. apart and, for the sake of good appearance, seams should be as inconspicuous as possible. Ducts located indoors may also be painted after the mineral wool finishing cement sets.



Corrugated metal bands and punched steel clips secure two layers of insulation to the wire mesh supports on this 600 F forced draft duct



Asphalt mastic troweled on 1 in. galvanized wire netting stretched over mineral wool finishing cement provides a weatherproof surface



Positioners can be installed in simple or involved piping systems and adapted for small or large valves

VALVE POSITIONERS . . . PART 2

Second and concluding article on valve positioners explains the operation and principles involved for positioners manufactured by numerous companies. No attempt has been made to list advantages nor disadvantages of the various makes

CHESTER S. BEARD, *Consultant*

Each manufacturer designs equipment to accomplish the functions of a valve positioner in the best possible manner. All devices are commercially proven. Some are representative of the type that converts controller output to proportional deflection and compares this to a proportional deflection created by the stroke of the valve stem. Other instruments convert controller output to a force, which can be compared to another force set up by the movement of the valve stem.

Certain valve positioners have been designed, either by physical characteristics or by function, that are different from the standard. At least one valve positioner has been designed to be an integral part of the top plate of the diaphragm case.

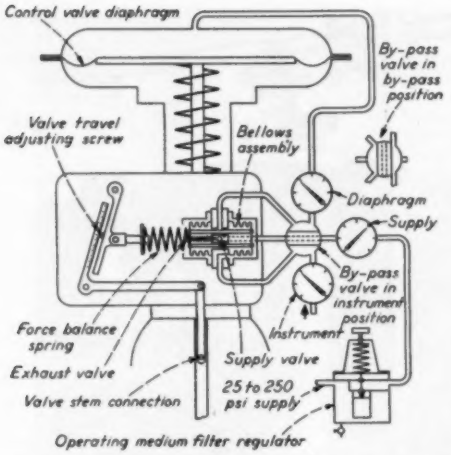
One valve positioner application evades the two classifications listed. The Conoflow rotomotor, has adapted the positioner principle to a pneumatic motor that positions the stem of large valves. This approach has many applications and would have been very acceptable some years ago to replace a group of large electric motor operated gate valves in order to make a compressor plant explosion proof.

Another example of deviation from standard design makes possible translating a linear controller output to another very different valve opening characteristic. With this instrument, a valve may be opened rapidly through a portion of its travel, or a semblance of the percentage characteristic may be obtained with a linear plug. This type of positioner may control a gate valve opening or plug cock to give a characteristic flow suitable for process control.

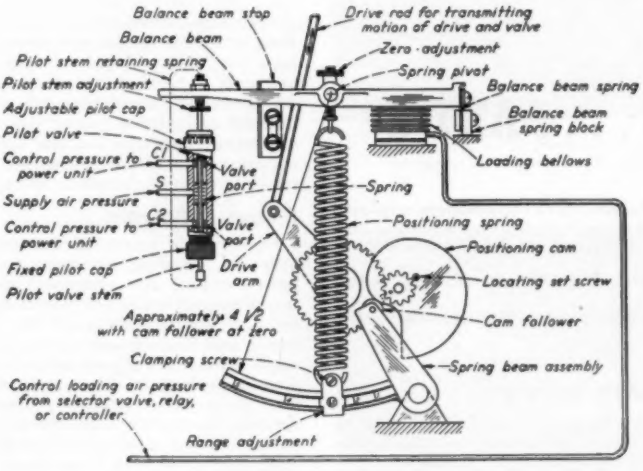
Pressure Differential

Utilization of single seated valves, with the attendant advantages for process control, has necessitated the consideration of methods of positioning the valve stem by other means than a spring loaded diaphragm. Springless diaphragm motors and pneumatic cylinders are products of this re-examination. These valve operators position the valve by creating a difference in pressure between opposite sides of the diaphragm or piston of correct magnitude to accurately position the valve.

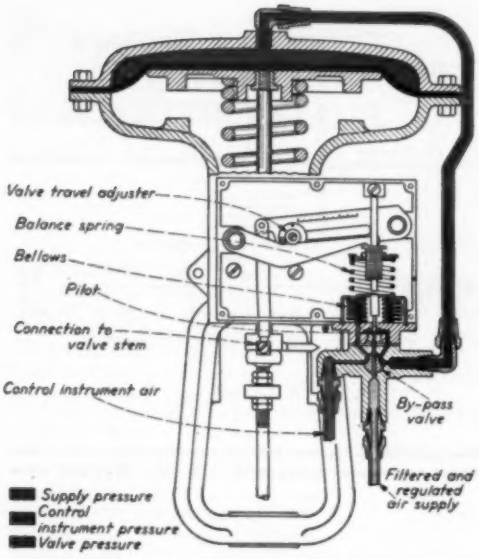
Advent of the positioner makes this quite possible. The force opposing the controlled air on the diaphragm may be constant air pressure applied to the opposite side of the piston or diaphragm. These forces may be greatly in excess of the pressures normally used for diaphragm motor valves. Addition of a reversing relay to the system gives greater range of power by varying the differential by decreasing the pressure on one side of the diaphragm or piston as pressure on the other side increases.



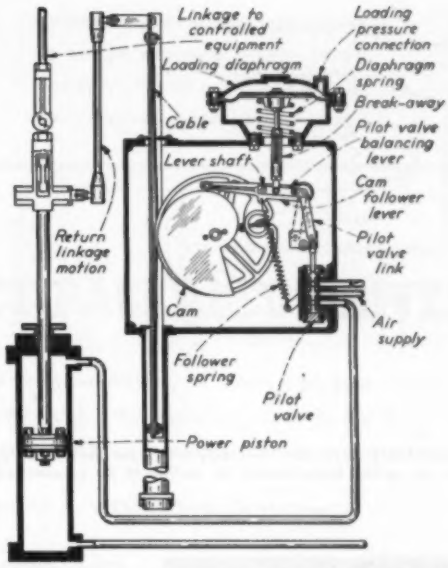
This assembly is comprised of two bellows mounted on opposite sides of a valve block and connected to each other by three push rods or posts, which go through openings in the block. One bellows is covered and sealed by a cap while the other has a shield with an open end so that the force balance spring can be seated directly on top of this bellows. A double action inner valve extends through second bellows so that the lower valve seats against the operating medium supply port in the valve block. The upper valve is the exhaust valve, which seats on the top of second bellows. A small internal spring holds the inlet valve closed. Operating medium air pressure shown is filtered and reduced by a combination air pressure filter and reducing regulator to 20 psi. An increase in controller or instrument pressure will overcome the spring force so that bellows assembly will move to the left and open supply valve. Operating medium supply pressure then enters the inside of both bellows and out through the passage to the main control valve diaphragm. The pressure sent to main diaphragm will continue to increase until downward movement of main valve stem applies enough force on balance spring to overcome increased pressure from primary controller so as to return bellows to its original position and close the supply valve. When instrument air pressure on the outside of the completely enclosed bellows decreases, the force balance spring will expand and cause bellows assembly to move to the right so as to open exhaust valve and bleed pressure off of the diaphragm of the control valve. With loss of pressure on control valve diaphragm, the valve stem will move upward and by means of the linkage and lever arms, will reduce the compression on the balance spring until the spring compression is again equal to the bellows force and the exhaust valve is closed



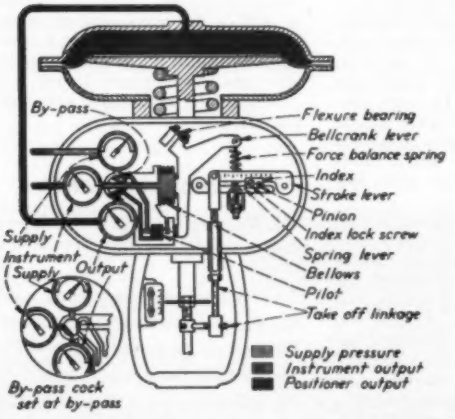
This positioner consists, essentially, of two opposing forces balanced one against the other to maintain a control valve position depending upon the magnitude of the forces. When the positioner is at balance, the force exerted upward on the balance beam by the loading bellows is equalled by the force exerted downward by the positioning spring. The force exerted by the loading bellows depends upon the control loading pressure to the bellows. The control loading pressure is that which has been established by the control system in accordance with demand for the controlled medium. Force exerted by the positioning spring depends upon the position of the valve stem (which, actually, is the position of inner valve) and the shape of the positioning cam. Valve stem is connected to positioner drive arm by means of a drive rod so that, for every position of the valve stem, the drive arm takes a corresponding position. This drive arm is geared to the positioning cam. The cam moves the spring beam assembly to give more or less tension to the positioning cam. The cam moves the spring beam assembly to give more or less tension to the positioning spring. Tension of the spring, then, depends on the position of the drive arm and, thereby, the position of the inner valve. The positioning cam enters into determining spring tension in that its shape may be whatever is required to give a desired characteristic of inner valve position vs control loading pressure. With the forces exerted by the loading bellows and positioning spring at balance, the balance beam holds the pilot valve stem in that position which will hold the position of the control valve constant. When the control system indicates, by a change in control loading pressure, that the control valve should be repositioned further open or further closed, the force exerted on the balance beam by the loading bellows is increased or decreased. This will raise or lower the balance beam and pilot valve stem to increase or decrease the control pressure to the diaphragm motor. As the control valve stem is moved by the diaphragm motor, the positioning spring tension is increased or decreased until the forces exerted by the bellows and spring are at balance again, the pilot valve stem assumes a new position, and motion of the control valve has stopped in its position



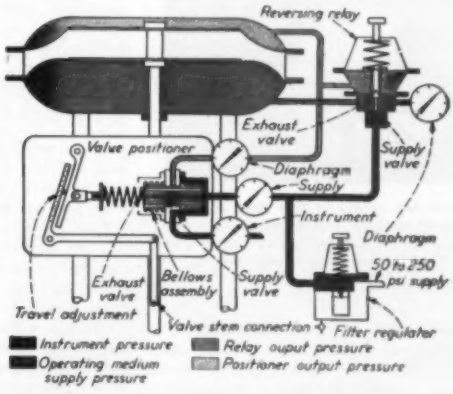
Balanced operation is obtained by spring loading the bellows to the same force exerted by control instrument air pressure. Change of control instrument air pressure moves the bellows and operates the air pilot. Supply air is admitted to the diaphragm motor chamber or exhausted past the pilot stem, causing the balance spring load to change. This returns the bellows and pilot to their original positions, thus restoring the balance



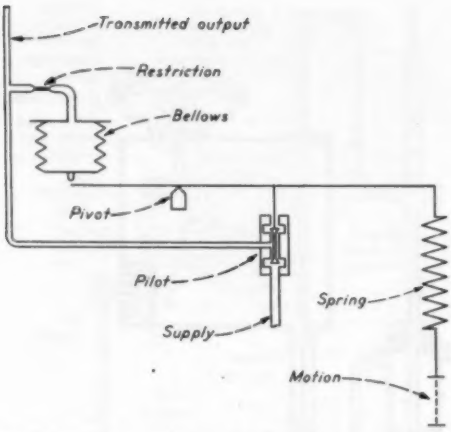
When pressure is zero, power piston and loading diaphragm are at top of stroke. Increased pressure causes diaphragm and stem to move down. Left end of balance lever pilots on cam follower lever and downward motion of diaphragm stem moves pilot valve link down. This admits air to the power cylinder and vents air from the bottom. Downward motion of power piston is transmitted to compensating cam. Pilot link and valve move up to neutral



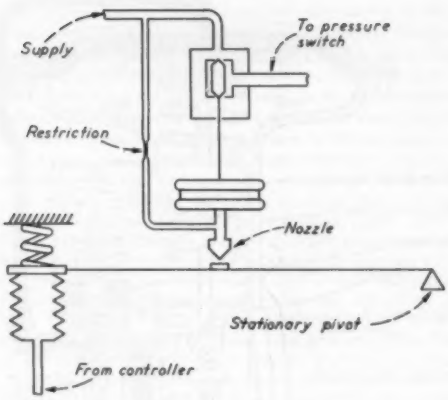
When pressure increases, the bellows rotates a bell crank lever on a frictionless flexure bearing, causing the pilot to increase positioner output pressure. Valve stem motion is transmitted through take-off linkage and positioner levers to the force balance spring. Spring tension on bell crank lever balances opposing bellows force. When these two forces are in balance the system is in equilibrium



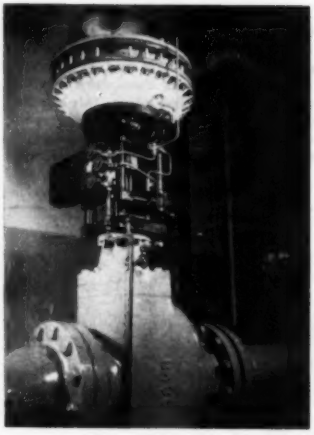
Sum of the top and bottom diaphragm pressure is equal to the supply pressure. Loading on each diaphragm depends upon the valve position. An instrument pressure increase moves the bellows assembly and opens supply valve to admit air to the top diaphragm of main valve. The assembly moves upward and opens the exhaust valve to bleed the lower diaphragm. Unbalance of forces results in a downward movement of the valve stem and a repositioning of the main inner valve. At the same time, downward stem movement causes additional force to be applied on the balance spring to bring the bellows assembly back into balance and close the supply



Pilot of this valve positioner supplies output pressure relative to spring force caused by motion to be transmitted



Two controllers function through one diaphragm valve. Positioner acts as snap acting relay to operate three-way valve



Reversing relays in this type of valve permit greater power range by varying pressure differential on either side of the diaphragm or positioner

Pneumatic valve positioners offer numerous possibilities. The following examples have been selected to emphasize these possibilities. Valve positioners as a motion transmitter have become so prevalent that some companies furnish the equipment adapted for this application. For example one pilot supplies an output relative to the spring force caused by the motion to be transmitted. An early application consisted of a contact plate to sense the top of a catalyst bed in a chamber of a "cat" cracker. A change in level of possibly 10 ft was translated through a worm gear to another vertical motion small enough to simulate valve stem travel. This was connected to the deflection beam of a deflection type positioner. The instrument was calibrated to obtain a 3-15 psi output with movement of the plate through its entire range.

Field Applications

Instrument engineers are continually confronted with systems, which can be operated to best advantage with two controllers. One instrument controls on one variable until the value of another variable reaches a predetermined limit, at which point the second controller takes over. Some systems utilize controlled output pressure from one controller as the supply pressure for the second controller. Some may be handled with a limit controller, which allows the variables to fluctuate until they reach predetermined limits.

One particular installation held a constant pressure on a gas line until the flow reached a maximum. At this point the flow, although limited, was to be kept at this limit if consumption warranted. Considerable economy was possible in using two controllers, but only one diaphragm control valve. The valve positioner was connected to act as a snap acting relay operating a three-way pilot for selection of the controller, which was to operate the gas valve. When the end of the deflection beam, normally connected to the valve stem, is held rigid—the range spring may be set at any predetermined point—the bellows will operate the pilot with a snap action. This snap-acting gadget may be used to advantage on the output of any pneumatic controller to sound alarms or put another instrument into service.

Although assuming some "tampering", the possibilities of ingenious uses of the pneumatic valve positioner are limitless. The valve positioner has become indispensable in its orthodox application and insures the correct position of a diaphragm motor valve under conditions that, without this accessory, would not be possible. The present trend towards full use of springless diaphragm motors, pneumatic pistons, as well as the reconsideration of the single seated valve for certain services, emphasizes their importance among instruments. The engineer dealing with process control should give instrumentation serious consideration.

ACKNOWLEDGMENTS

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COMPACT PACKAGED DRIVES

Modern packaged drives, consisting of motor and gear reduction units, whether assembled by the manufacturer or in the field, are proving a compact transmission item easy to install and maintain

FRANCIS A. WESTBROOK, *Consultant*

PACKAGED MOTOR DRIVES incorporating speed reduction features are being used more extensively. This is largely because constant high speed motors are generally the most economical from the standpoint of operation, maintenance and first cost. Furthermore, they are suitable for a wide range of applications and often the machines driven must be operated at lower speeds than the motors. Advantages of a high speed motor for a low speed drive are thus retained, and the compactness and neatness of the packaged drives are an important consideration.

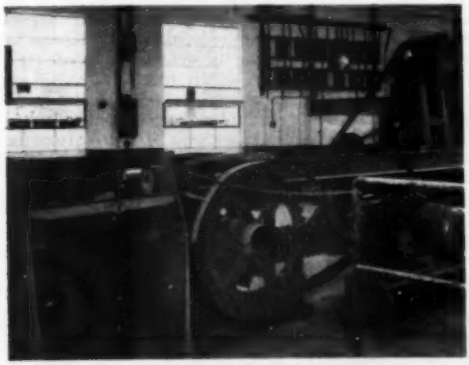
One type of packaged drive is the gearmotor having reduction gears to change the high motor speed to the relatively low drive speeds required for various machines. These drives are built to operate safely without slippage and with the minimum loss of power. They are also quiet in operation and are available in a wide range of output speeds up to 75 hp rating. They can be adopted for standard motor enclosures such as open, splashproof, totally enclosed fan cooled, explosionproof and non-ventilated enclosed.

Another type of packaged drive designed to carry overhung loads without deflection has a speed reducing element separate from the motor but mounted on the same base plate. The two elements are connected with a flexible coupling. However, particular attention must be paid to assembly alignment at the factory, although provision is made for adjustment on the job if necessary. These units are available in a variety of ratings and speed ratios with double or triple reduction gears.

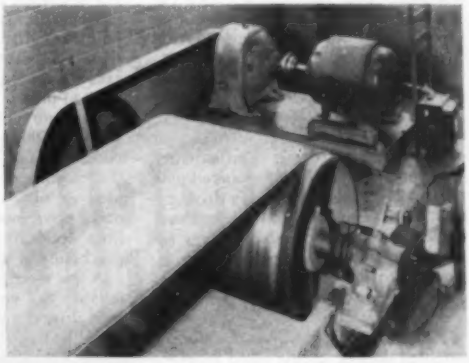
Of course helical reduction gear can sometimes be purchased separately. This requires mounting the unit on a base with motor and coupling the two together, taking great care to secure good alignment. How these drives work out in practice can best be explained by considering a few examples taken from actual applications.

In one instance a gearmotor was designed for handling logs and lumber. It provided the reciprocating motion to operate log haul unloaders, roll case unloaders, log kickers, lift skids and chain transfers. The unit was made up of a number of standard parts consisting of a hoist type gearmotor with heavy duty gearing, a motor-operated brake and two limit switches. Two cams on the crank arm of the output shaft were adjustable to obtain a crank rotation of 180 or 360 deg from the starting point. This assembly, mounted on a fabricated steel base, forms a very compact drive without any exposed moving parts to accumulate dirt. It is consequently easy to maintain under most service conditions.

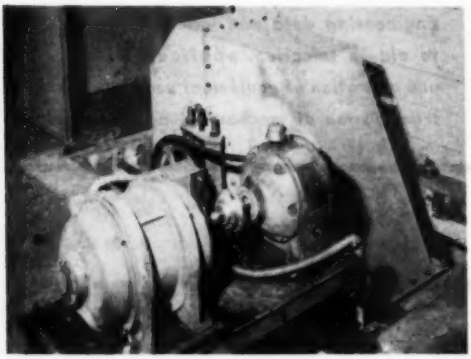
Recently a gearmotor was installed in a New England paper mill. When the pulp mill was enlarged a new pulp-

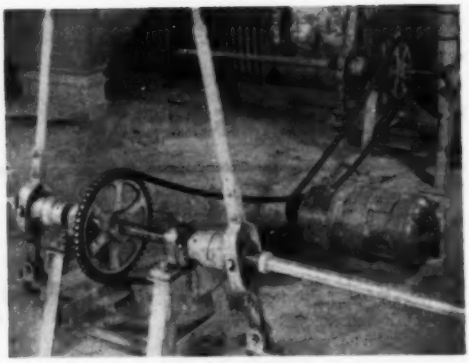


Conveyer connected to packaged drive handles wood pulp in paper mill. Power is transmitted through narrow flat belt



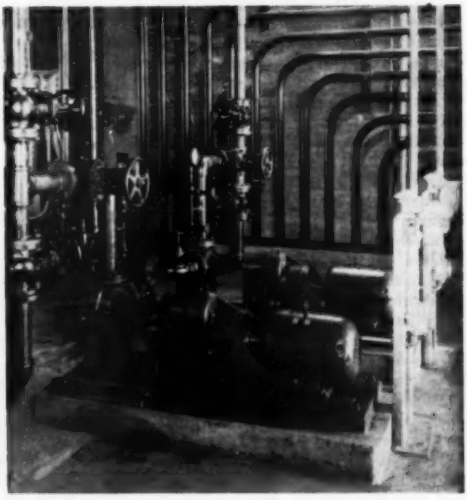
Gear unit with standard motor drives the head shaft of a flat belt conveyor pulley through a single strand chain





Gear speed reducer and 3 hp motor packaged unit drives a core sand elevator

A totally enclosed fan cooled gearmotor drives two agitators



Motor and gear speed reducer combination on common base for drive of oil pump in a Texas oil refinery

wood conveyer was installed to move the material from the outdoor storage pile or railroad cars to the chipper. As a large speed reduction was required, this drive proved to be the answer.

Compactness and neatness that can be obtained from packaged drives are of great importance. For example, such a unit composed of a 5 hp explosionproof motor drives a pump through gear reducers with an output speed of 640 rpm. All items are mounted on the same base, and the pump transports oil for filling small cans in a Texas oil refinery. Pushbutton control stations are conveniently mounted in front of the motors. A similar drive—except that the motor is 7½ hp and the output speed of the reducer 720 rpm—pumps out an oil line preparatory to transporting another type of oil. The refuse from the oil line is delivered to a settling tank.

In an oil refinery, explosionproof motors are a necessity, but under normal circumstances some other type would be suitable. In any event, this type of drive without belts, chains or exposed gears is not only much more compact, but is simple to install and maintain. Ball bearings are used exclusively and the explosionproof motors are built for 55 C continuous or part time duty.

These two installations illustrate the interesting development whereby motors may be equipped with gear speed reducers to form an integral part of the packaged drive. Furthermore, any type or make of foot mounted motor can be employed for this drive up to 50 hp. The unit may also be mounted vertically for vertical shaft drives by providing a simple mounting flange attached to the outside end of the reducer housing, which can be belted to the driven machine.

Flanged type NEMA motors may be mounted directly on the speed reducer, this arrangement may also be mounted vertically. This of course affords a more compact drive. The speed reducing units are made with extra overhung load capacity to take care of heavy extraneous loading.

Generally gear speed reducers are built in accordance with American Gear Manufacturers Association standards for this type of service. Development of motors and gear speed reducers as separate units brings together the ways to make a compact drive for great flexibility and convenience. The fact that existing motors may frequently be used in such combinations may well make drive modernization along these lines decidedly more economical than purchasing a gearmotor.

A few more specific applications will indicate the versatility of these packaged drives to show how well they can be applied. A 3 hp motor was mounted on a welded base with an enclosed helical gear speed reducer and connected with an enclosed flexible chain coupling to drive the head shaft of a core sand elevator in a foundry. There is a movable plate between the motor feet and the welded base to provide for adjustments, although such adjustments are reduced to the minimum by mounting the whole drive on one rigid base. A similar drive was installed for a belt conveyer in the same plant, with the control very conveniently located close to the motor. The drive from the output shaft of the reducer to the head shaft of the conveyer is by suitably guarded roller chain.

A group of 3 hp gearmotors has been employed to drive 48 in. wide apron feeders under zinc concentrate bins. The speed reduction is large, and the compactness of the drive is highly desirable on account of the limited space. Ball and roller bearings are used throughout, and lubrication is automatic as the oil circulates through a large reservoir.

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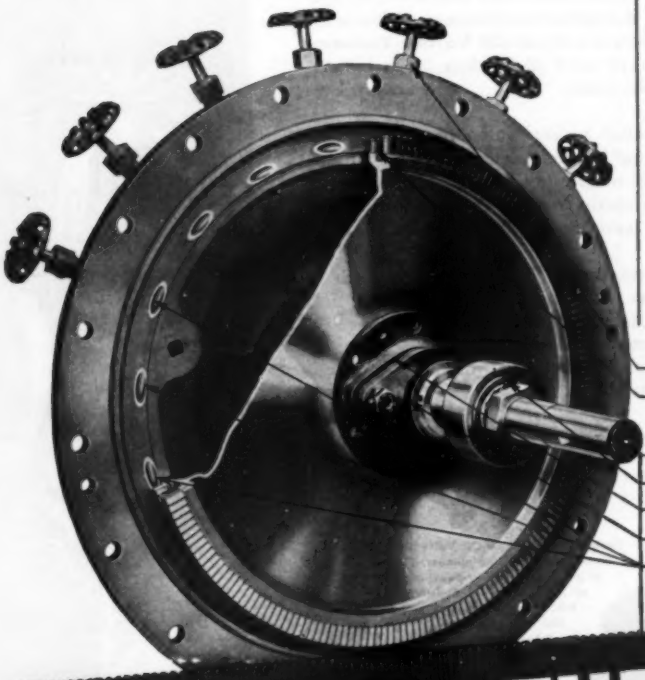

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A — Fully resistant
B — Satisfactorily resistant
C — Fairly resistant
D — Not resistant

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Corroding agents	Stainless	Bronze
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70 F	A	B
Boiling to 50%	B	C
Acetic Anhydride	A	B
Acetic Vapors	C	C
Acetone	A	B
Alcohol (Methyl, Ethyl, Proply, and Butyl)	A	B
Aluminum Acetate	A	B
Aluminum Chloride	C	B
Aluminum Sulfate		
70 F	A	B
Boiling	B	—
Aluminum Potassium Sulfate (Alum)		
70 F	A	B
Boiling	B	B
Ammonia (Ammonium Hydroxide)	A	X
Ammonium Bicarbonate	A	B
Ammonium Chloride (Sal Ammoniac)		
70 F	A	B
Boiling	B	C
Ammonium Nitrate	A	B
Ammonium Oxalate	A	B
Ammonium Persulfate	A	B
Ammonium Phosphate	A	B
Ammonium Sulfate		
70 F	A	B
plus 0.5% H_2SO_4	A	C
plus 5.0% H_2SO_4	C	C
Aniline	A	B
Aniline Hydrochloride	C	X
Antimony, Molten, 1100 F	X	X
Baking Soda (Sodium Bicarbonate)	A	B
Barium Carbonate	A	B
Barium Chloride		
70 F	A	B
Hot	B	B
Barium Nitrate	A	B
Barium Sulfate	A	B
Beer	A	B
Beet Juice	A	B
Benzine (Benzol)	A	B
Benzoic Acid	A	B
Bichloride of Mercury		
Less than 0.1%	A	B
Greater than 0.7% cold	B	B
Greater than 0.7% hot	C	C
Bleaching Powder (Calcium Hypochloride)	C	B
Blood (Meat Juices)	A	B
Blue Vitriol (Copper Sulfate)	A	B
Borax	A	B
Boric Acid	A	B
Bromine	X	C
Buttermilk	A	B
Butyric Acid	A	B
Calcium Carbonate	A	B
Calcium Chloride (Alkaline)	A	B
Calcium Oxychloride	C	B
Calcium Sulfate	A	B
Carbolic Acid	A	B
Carbon Bisulfide	A	X
Carbon Monoxide	A to 1600 F	B to 800 F
Carbon Tetrachloride	B	B
Carnallite (Potassium, Magnesium Chloride)	B	B
Caustic Lime, Potash or Soda (Calcium, Potassium, or Sodium Hydroxide), Lye		
70 F	A	B
Boiling	B	C
Cellulose	A	C
Chlorine Gas		
Dry	C	C
Moist	X	C
Chlorinated Water	C	C
Chlorobenzine	A	B
Chloroform	A	B
Chromic Acid		
70 F	A	B
Boiling	C	C
With SO_4, Boiling	X	X
Chrome Alum	A	B
Boiling	X	C
Citric Acid		
70 F	A	B
Boiling	C	B
Coca Cola Syrup	A	B
Copperas (Ferrous Sulfate)	B	B
Copper Acetate	A	B
Copper Carbonate	A	B
Copper, Cyanide	A	C
Copper Nitrate	A	B
Copper Sulfate	A	B
Creosote	A	C
Cyanogen Gas	A	B
Dichloro-ethane	A	C
Developing Solutions	A	B
Dutch Liquor	A	B
(Dichloro-ethane)	A	C
Dyewood Liquor	A	B
Epsom Salts (Magnesium Sulfate)	A	B
Ether	A	B
Ferric Hydroxide	A	B
Ferric Chloride	C	C
Ferric Nitrate	A	B
Ferric or Ferrous Sulfate	B	C
Formaldehyde (Formalin)	A	B
Formic Acid	B	B
Fruit Juices	A	B
Fuel Oil	A	B
Fuel Oil containing Sulfuric Acid	C	B
Gallic Acid	A	B
Gasolene	A	A
Glauber's Salt (Sodium Sulfate)	A	B
Glue	A	B
Glue, acidified	B	B
Glycerine	A	B
Grape Juice	A	B
Gypsum (Calcium Sulfate)	A	B
Hydrogen Peroxide	B	C
Hydrobromic Acid	C	B
Hydrochloric Acid (Muriatic)		
70 F	C	C
Boiling	X	C
Hydrocyanic Acid (Prussic Acid)	A	B
Hydrochloric Acid fumes	C	C
Hydrofluoric Acid fumes	C	C
Hydrofluosilic Acid	C	C
Hydrofluosilic Acid fumes	X	C
Hyposulfite of Soda (Hypo, Sodium) Thiosulfate)	A	B
Hydrogen Sulfide		
Dry	A	X
Moist H_2SO_4 present	C	X

Acknowledgment is made to the Atlas Chain & Manufacturing Co. for data in this article.

Corroding agents	Stainless	Bronze
Inks		
Alkaline	A	B
Acid	B	B
Iodine		
Dry	A	C
Moist	X	C
Iodoform	A	B
Kerosene	A	A
Ketchup	A	B
Lactic Acid		
70 F	A	B
150 F	C	B
Lard	A	C
Lead, Molten, 1200 F	B	X
Linseed Oil	A	B
Lye (Sodium or Potassium Hydroxide)		
70 F	A	B
Boiling	B	C
Lysol	A	B
Magnesium Chloride		
70 F	B	B
Hot	C	B
Magnesium Sulfate	A	B
Malic Acid	A	B
Manganese Chloride	A	C
Marsh Gas (illuminating gas)	A	B
Mash, Hot	A	B
Mayonnaise	B	B
Mercury	A	B
Methyl Aldahyde	A	B
Milk—Sweet or Sour	A	B
Mine Water, Acid	A	C
Molasses	A	B
Naphtha, pure or crude	A	B
Nickel Chloride	B	B
Nickel Sulfate	A	B
Nitre (Potassium Nitrate)	B	X
Nitric Acid		
70 F	A	X
Concentrated Boiling	B	X
Nitric Acid, Fuming, Concentrated, Boiling	C	X
Nitrous Acid	A	X
Oleic Acid	B	B
Oils, Mineral or Vegetable, Refined	A	B
Oils, Mineral or Vegetable, Crude	B	B
Oxalic Acid	A	B
Paraffin	A	A
Phenol (Carbolic Acid)	A	B
Petroleum	A	A
Petroleum Ether	A	A
Phosphoric Acid, Technical	B	B
Boiling Crude	X	X
Picric Acid	A	B
Plaster of Paris (Sulfate of Lime, Gypsum)	A	B
Potash (Potassium Carbonate)	A	B
Potassium Bitartrate	B	B
Potassium Bichromate	A	C
Potassium Bromide	B	B
Potassium Chlorate	A	B
Potassium Chloride	B	B
Potassium Cyanide	A	C
Potassium Ferricyanide	A	C
Potassium Hydroxide		
Boiling	B	B
Molten, 650 F	X	X
Potassium Hypochlorite	B	C
Potassium Iodide	A	B
Potassium Nitrate	A	C
Molten, 1000 F	B	X
Potassium Oxylate	A	B
Potassium Permanganate	A	B
Potassium Sulfate	A	B
Potassium Sulfide	A	X
Pyrogallic Acid	A	B
Prussic Acid	A	B
Quinine Sulfate	A	B
Quinine Bisulfate	B	B
Rosin, Molten	A	B
Salt (Sodium Chloride, Salt Brine) 70 F	A	B
150 F	B	B
Sea Water	B	B
Sewage	A	B
Sewage, sulfuric acid present	B	B
Silver Bromide	B	B
Silver Nitrate	A	B
Soda Ash (Sodium Carbonate)	A	B
Sodium Acetate	A	B
Sodium Bicarbonate	A	B
Sodium Bisulfate	A	B
Sodium Bisulfite	A	B
Sodium Citrate	A	B
Sodium Chlorate	A	B
Sodium Chloride	A	B
70 F	A	B
150 F	B	B
Sodium Cyanide	A	B
Sodium Fluoride	B	B
Sodium Hydroxide	A	B
Sodium Hydroxide Molten, 600 F	B	B
Sodium Hypochlorite	B	C
Sodium Hypochlorite, slightly alkaline	A	C
Sodium Perchlorate	A	B
Sodium Hyposulfite (Hypo)	A	B
Sodium Nitrate (Chili Saltpetre, Soda Nitre)	A	B
Molten, 600 F	B	B
Sodium Peroxide	A	B
Sodium Salicylate	A	B
Sodium Sulfate	A	B
Sodium Sulfide	B	X
Sodium Sulfite	A	B
Sodium Thiosulfate	A	B
Soap	A	B
Stannic Chloride (Tetrachloride of Tin)	X	C
Stannous Chloride	C	C
Starch	A	B
Strontium Hydroxide	A	B
Strontium Nitrate	A	B
Sugar or Cane Juice	A	B
Sulfur, Dry		
Molten, 260 F	A	X
Molten, 750 F	C	X
Sulfur Chloride	A	B
Sulfur Dioxide Gas, Moist	B	B
Sulfurous Acid Water solution		
Atmospheric Pressure	A	B
Over 60 PSI Pressure	C	B
Sulfuric Acid		
70 F	B	B
Boiling	X	C
Sulfuric Acid, Fuming	C	C
Sulfuric Acid, Vapor	B	B
Tannic Acid	A	B
Tanning Liquor	A	B
Tartaric Acid	A	B
Tetrachloride of Tin	X	C
Tin, Molten, 1100 F	X	X
Trichloroethylene	B	B
Uric Acid	A	B
Varnish	A	B
Vinegar (Acetic Acid)	A	B
Whiskey	A	B
Wood Pulp	A	B
Yeast	A	B
Zinc, Molten, 1100 F	X	X
Zinc Chloride		
100 F	A	B
Boiling	C	B
Zinc Cyanide	A	B
Zinc Nitrate	A	B
Zinc Sulfate (White Vitriol)	A	B

MAXIMUM BORE DIMENSIONS FOR DRIVING SPROCKET IN INCHES

Number of teeth	Chain Pitch, Inches									
	⅜	½	⅝	¾	1	1¼	1½	1¾	2	2½
15	7/8	1¼	1½	1⅞	2⅞	3⅞	3⅞	4½	5½	6⅝
16	1	1⅜	1⅝	2⅛	2¾	3½	4⅛	4⅞	5½	7
17	1	1⅜	1¾	2¼	2⅞	3¾	4½	5¼	6	7½
18	1⅛	1½	1⅞	2⅜	3⅛	4	4¾	5⅝	6½	8⅛
19	1¼	1⅝	2⅛	2⅝	3⅜	4⅛	5¼	6	7	8⅝
20	1⅜	1⅝	2¼	2¾	3⅝	4⅝	5⅝	6½	7⅝	9⅛
21	1⅜	1⅞	2⅜	2⅞	3⅞	4⅞	5¾	6⅞	7⅞	9⅞
22	1⅜	1⅞	2½	3⅛	4	5⅛	6¼	7⅜	8½	10⅛
23	1½	2⅛	2⅝	3¼	4¼	5½	6⅝	7⅝	9⅛	11⅛
24	1⅝	2¼	2⅞	3⅜	5⅜	5⅝	7	8⅛	9⅝	11⅝

Now's the time to install THE NEW CANTON TURBO-AIRE OVER-FIRE AIR SYSTEMS

BURNS ALL THE FUEL— INCLUDING THE SMOKE
DIRTY SMOKY FIRE CAUSED BY INCOMPLETE COMBUSTION
CLEAN FIRE, COMPLETE COMBUSTION with TURBO-AIRE

Diagrammatic views showing the difference between incomplete combustion, and the clean hot fire and total combustion made possible with TURBO-AIRE.

Here is your low-cost answer to higher combustion efficiency and elimination of the smoke nuisance!

By an extremely simple and highly efficient method, TURBO-AIRE injects a high air turbulence into the combustion area above the fire bed. This breaks up the direct draft to the flue and stack, supplying additional oxygen and keeping the partially burned volatile materials and gases in the high-heat area until maximum combustion has been obtained.

By this simple proven scientific principle TURBO-AIRE insures maximum combustion of the fuel used, with more heat per pound of fuel burned, elimination of smoke and soot, and cleaner flues and stacks.

Improve the efficiency of YOUR plant with low-cost TURBO-AIRE. Its operation in your heating or power equipment will quickly prove a profitable investment.

Full information on TURBO-AIRE and its advantages may be had by sending the attached coupon to CANTON STOKER CORPORATION, Andrew Place, S.W., Canton 1, Ohio.

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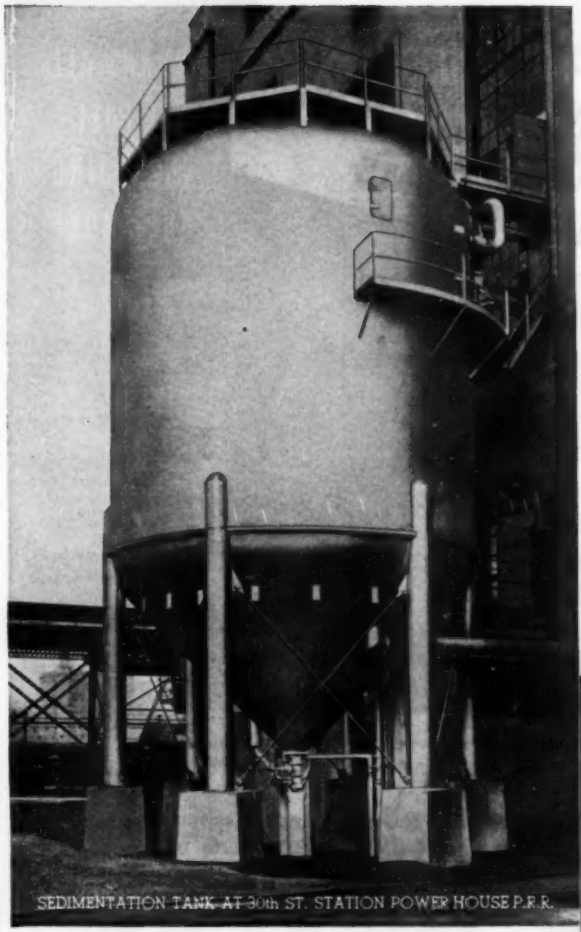
CANTON 1, OHIO



SEDIMENTATION TANK AT 30th ST. STATION POWER HOUSE P.R.R.

COCHRANE Hot Process SOFTENER

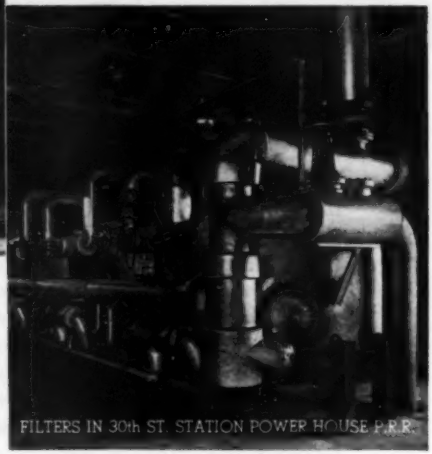
Serves a Great Railroad

ONE of the features of the huge Pennsylvania Station — 30th Street, Philadelphia, of the Pennsylvania Railroad is the ultra modern power plant, designed by internationally recognized architects and engineers.

Recently installed in this power plant to serve additional capacity is a Cochrane Hot Process Softener for the boiler feed. It will handle 80,000 gallons per hour makeup and 10,000 gallons per hour condensate.

Cochrane pioneered the development of the hot process for softening boiler feed, and has continued to lead in the field of water conditioning ever since. In recent years, Cochrane has made many installations of the new Hot Process Zeolite Softener, wherein external second stage of softening is accomplished by means of ion exchange.

Consult Cochrane on any water conditioning problem.



FILTERS IN 30th ST. STATION POWER HOUSE P.R.R.

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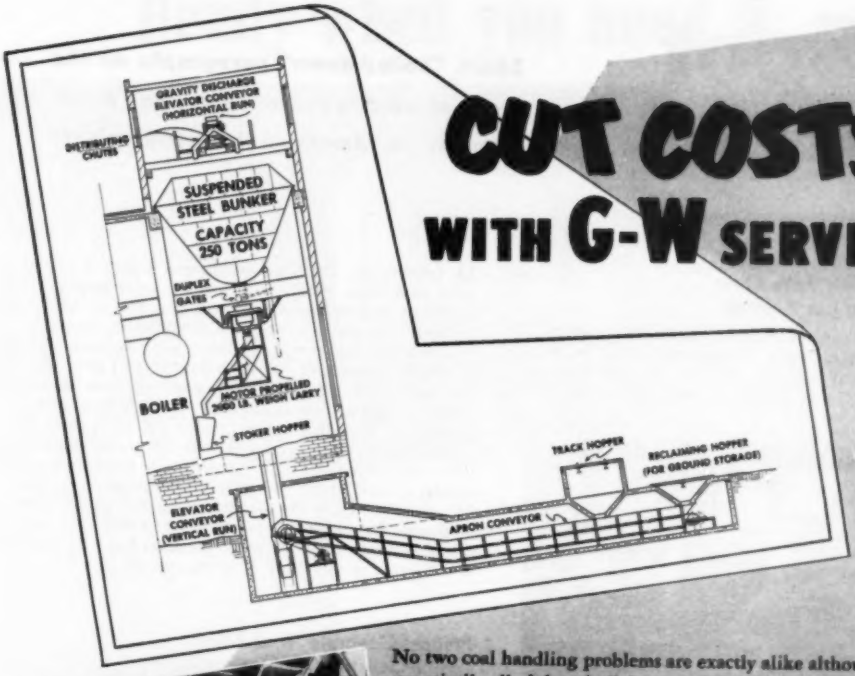
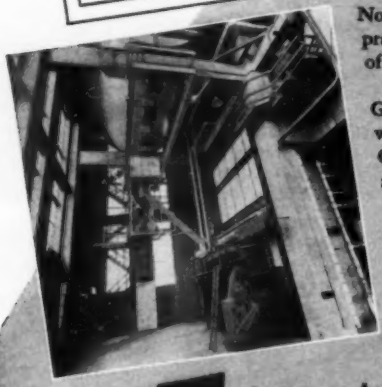
RECUPERATION THERMIQUE & EPURATION	PARIS

COCHRANE

PIONEERS AND LEADERS IN BOILER FEED PROCESS & INDUSTRIAL WATER CONDITIONING
COCHRANE CORPORATION
89
YEARS OF SERVICE
1863 - 1952

CUT COSTS WITH G-W SERVICE





No two coal handling problems are exactly alike although practically all of them boil down to G-W's four basic types of storage and handling.

For example, at a large U.S. Government arsenal, G-W designed and installed the suspended steel bunker with a gravity discharge bucket elevator shown at left. Coal is carried on the upper run of the conveyor, permitting free access to machinery and maximum bunker capacity. A cab-type weigh larry with recording beam provides clean, economical operation.

G-W conveyor system with capacity of 60 tons per hour. System consists of a Rail and Truck Hopper, a 30-inch Apron Conveyor, Gravity Discharge Elevator, 250-ton Suspended Steel Bunker and a 2000-lb. Weigh Larry.

4 BASIC WAYS TO CUT COAL HANDLING COSTS

No matter what your coal and ash handling problem is, from one of 4-basic types... Concrete Silos, Vitrified Tile Silos, Cylindrical Steel Tank, and Suspended Steel Bunker... G-W engineers can install the most efficient and economical storage and automatic handling system to fit your requirements of space, capacity and initial cost. Their recommendations to you, will be based on more than 140 years of design and engineering experience and on the performance records of hundreds of successful installations.

Fourteen interesting case histories, based on these 4 G-W basic designs, are described in Bulletin No. 300. Write for your copy, today.

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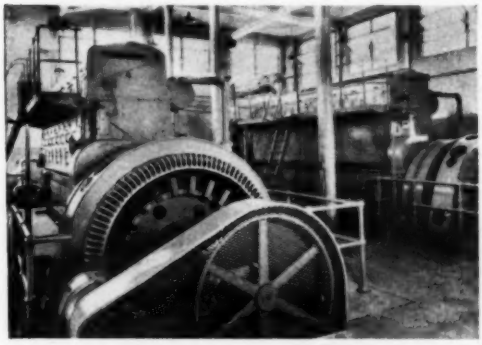
G-W HANDLES IT... faster • easier • cheaper

Spot news

Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants

Dual-Fuel Engines Take Over Bulk of Load at Las Animas

Two dual-fuel engines, recently placed in operation at Las Animas Light & Power, Las Animas, Colorado, more than triple the plant's capacity. For the first time in its ten year history the plant is capable of carrying the city's demand independent of purchased power. In addition, the new engines have taken over most of the load from three existing diesel engines having a total capacity of 700 kw. Elimination of power being purchased and lower production costs due to utilization of natural gas are expected to increase profits more than $50,000 a year.

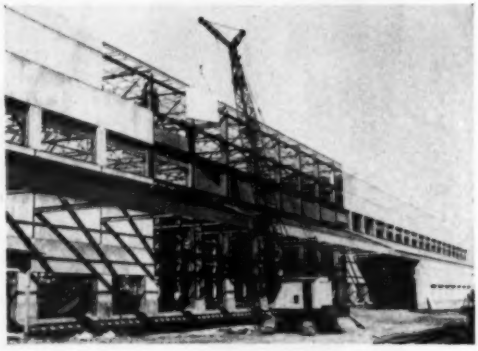


The two new Duafuel engines, made by Nordberg Manufacturing Co., are identical except that one is supercharged. Both are four-cycle units with eight cylinders of 16 in. bore and 22 in. stroke, developing rated horsepower at 327 rpm. The supercharged unit has a sea level rating of 1750 hp, or 1610 hp at the city's 3877 ft elevation. The other engine is rated 1050 hp at this altitude. Capacities are 1130 and 735 kw respectively. The non-supercharged engine is equipped with an oversize generator to permit supercharging at a later date. It is estimated that production will be 5,700,000 kwh in 1952, and may exceed 7,200,000 kwh by 1958.

Test results and actual experience with the new engines in the first months of operation indicate fuel costs will be less than 4 mills per kwh. Total generating costs are calculated to be approximately 6.6 mills. This compares with the previous 15.66 mills for diesel power and 12.91 mills paid for purchased power. Present price for 29 gravity low-sulfur diesel fuel oil is 10.74 cents per gal, while average price for natural gas is 27 cents per 1000 cu ft. The power company has offered to retain the old interconnection without standby charge, demand charge or contract, and will make power available if needed. The city, on the other hand, has agreed to sell power to the utility in an emergency.

Precast Concrete Wall Panels Lower Construction Costs

Precast concrete wall panels are being used in the erection of what will be one of the nation's largest industrial plants. The Marietta Concrete Corp. is producing the panels for Union Carbide & Carbon Corporation's Electro Metallurgical Div. at Marietta, Ohio. Several buildings in this $100,000,000 expansion program have been completed, the first being a steam power station using approximately 60,000 sq ft of concrete wall panels. As a result of experience with the power plant, contracts for 500,000 sq ft of panels for other buildings in the program were awarded.



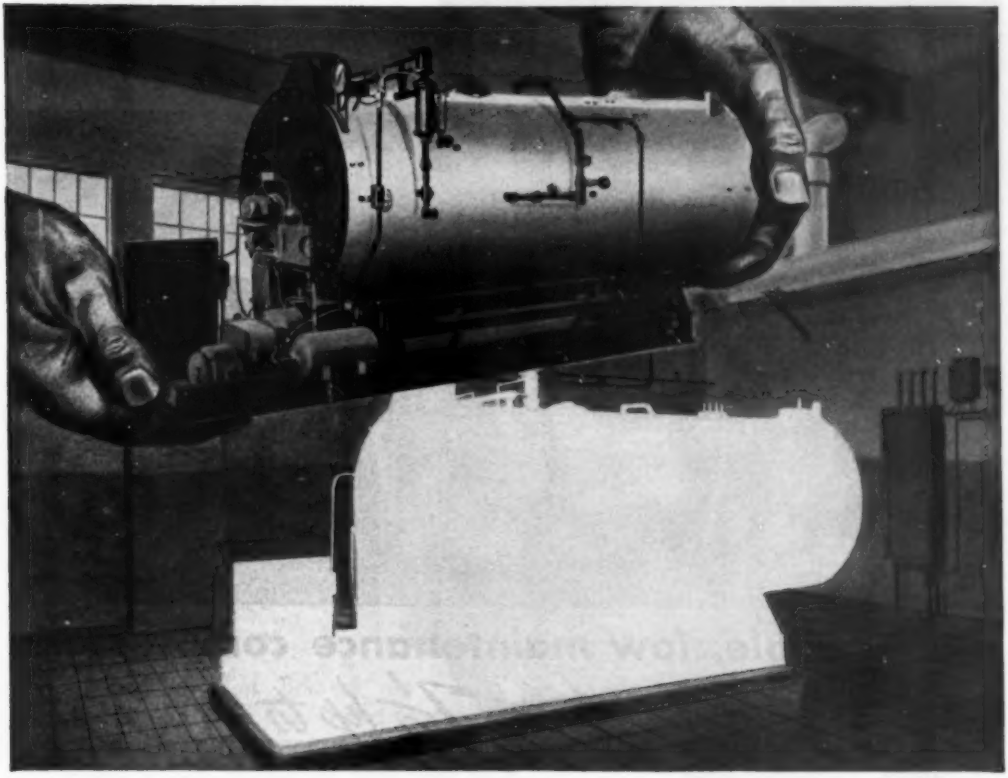
Factors involved in selection of this type of construction included initial cost, maintenance costs, erection time, durability, thermal conductivity and possibilities of large scale

(Continued on page 112)

The Cover - Our Industrial Strength

Charging an open hearth furnace is routine to a steelman, but to every American the scene on the cover is a comforting symbol of our industrial strength. Already producing at the rate of approximately 108 million ton per year, steel companies are building to a capacity of 118 million ton by the end of 1952. Reprinted from STEELWAYS, published by American Iron and Steel Institute.

Ready when you need it...



Save Installation-Construction Time — Expedite Emergency Installations — Serve Immediate Temporary Steam Needs — With a Cleaver-Brooks Self-Contained Boiler

WHEN speed is vital, you can save weeks of valuable installation time with a Cleaver-Brooks boiler — delivered to location as a complete, factory assembled and tested, self-contained unit, with much of the trim and accessories provided.

In an emergency the installation time can be reduced to as little as 48 hours, by following a properly planned and coordinated procedure of providing in advance the required facilities — foundations, headers, service and blow-off lines, fuel tanks and lines.

Prior to the completion of your building, Cleaver-Brooks boilers can be placed in operation to serve immediate steam needs. When permanently installed the change-over takes place with a minimum of labor and expense and the avoidance of interrupted steam service.

Cleaver-Brooks are the first and finest in modern, self-contained boilers — operate at a guaranteed efficiency of 80% — burn the fuel most available and economical in your area, gas, oil, or combination gas and oil — fully meet all codes — standard models available in sizes 15 to 500 hp; 15 to 250 psi.

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Originators of the Self-Contained Boiler
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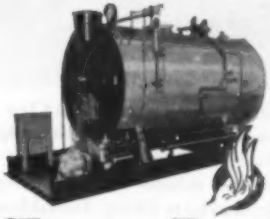
Write for latest, fully illustrated and descriptive Cleaver-Brooks Steam Boiler Catalog.

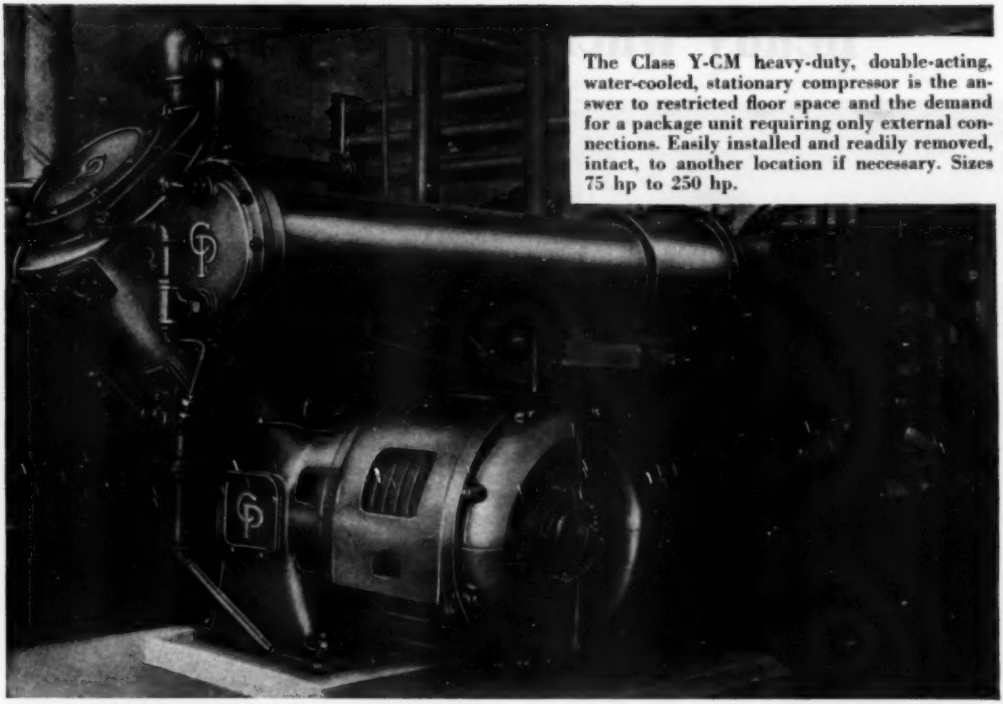
WHY INSTALLATION TIME IS CUT:

- Simple Low-Cost Stack
- No Job-Site Brickwork — No Special Foundations
- Boiler Delivered as a Complete, Factory Assembled, Tested, Self-Contained Unit
- Centralized Responsibility — No Waiting on Multiple Sources of Supply



Cleaver-Brooks

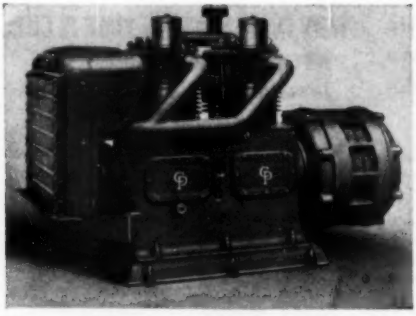
Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners



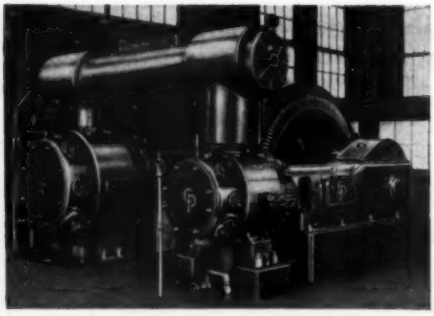
The Class Y-CM heavy-duty, double-acting, water-cooled, stationary compressor is the answer to restricted floor space and the demand for a package unit requiring only external connections. Easily installed and readily removed, intact, to another location if necessary. Sizes 75 hp to 250 hp.

dependable, low maintenance compressors

from 7½ hp to 2000 hp



The small, compact, two-stage Class PM compressor—air-cooled for all-weather operation—may be installed independently of main air system. Also suitable for off-hour operations. Sizes from 25 hp to 100 hp. Available with built-in motor, flexible coupling or V-belt drive.



Built in the larger sizes — up to 2000 hp, Class O-CE horizontal duplex motor-driven compressors meet all load demands most economically, and "last forever."

Write for further information on these and other types of CP Stationary Compressors.

CHICAGO PNEUMATIC TOOL COMPANY

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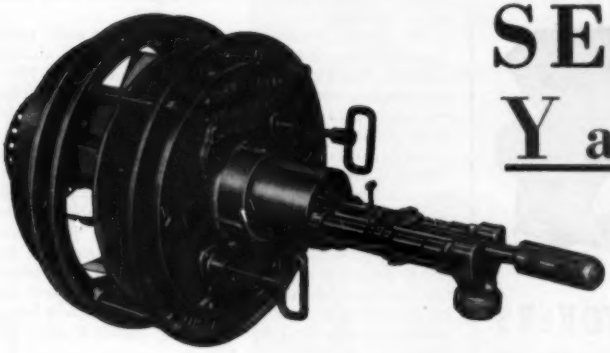
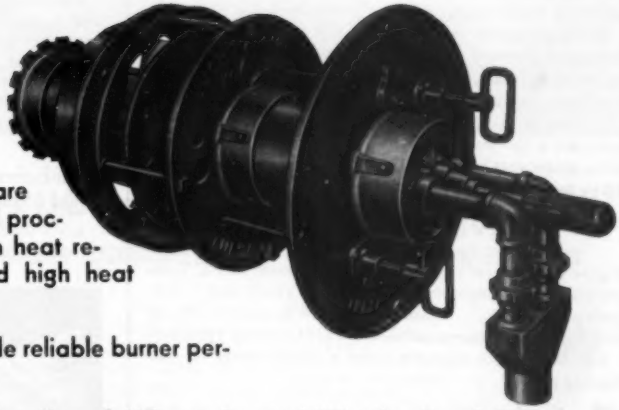
JOHN ZINK

Combination Gas and Oil Burners

SERIES Y and YC



Maximum Duty
Minimum Draft



These John Zink Burners are recommended for boilers and process furnaces where maximum heat release at low excess air and high heat density is required.

The Series Y and YC provide reliable burner performance at low first cost.

Features of both the Series Y and YC are Rugged Weather-Proof Construction; Easy to Remove Fuel Guns; Light Weight Fuel Guns; Burn Any Commercial Fuel Oil; Burn Any Gas at Reasonable Pressure; Draft—Natural, Forced or Induced; Center Firing of Both Fuels; Will Operate With Either Fuel as well as in Combination; Can Be Equipped With Any Standard Type Controls.

All parts of the burners are easily cleaned, and they have the lowest consumption of fuel for atomization.

Air Heaters

Field Flares

John Zink Burners are covered by 24 United States and Foreign Patents.

Write for Bulletin Series Y and YC.

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- less work
- lower cost

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AUTOMATIC COAL STOKERS

We can prove that **Combustioneer** will produce *more* heat with *less* work and *pay for itself* from actual fuel savings.

Combustioneer exclusives make it possible. **Combustioneer's** patented automatic respirator is the only device which uses free air flow to control combustion positively, accurately, automatically. Hopper and Bin-Feed Models. Capacities 9 to 1100 lbs. per hour. On Bin-Feed Models—patented worm transfer mechanism eliminates gear or chain drive under coal pile. Pick-Up Worm Section extends up to 16½ feet under coal pile.

SAVE UP TO 30%

Figure your *present cost* . . . find out how many B.T.U.'s you are buying for your present fuel dollar. You'll find it *staggering!* But now . . . figure that you can save *up to* 30% of that figure with **Combustioneer.** That's *heating efficiency!*

Let one of our engineers make a FREE survey of your heating plant!

Combustioneer GAS BURNERS • HIGH AND LOW PRESSURE OIL BURNERS • STOKERS • COAL-GAS-OIL FURNACES • HUMIDIFIERS

"Better Heating Since 1928"

Combustioneer DIVISION
THE STEEL PRODUCTS ENGINEERING CO.
Springfield, Ohio

Mail this coupon now . . . TODAY!

Combustioneer DIVISION
THE STEEL PRODUCTS ENGINEERING CO.
1221 W. Columbia St., Springfield, Ohio

Please send us, without obligation, information about all Models of **Combustioneer** Stokers, case histories of other users, and details of your FREE heating survey.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

Spot news

(Continued from page 108)

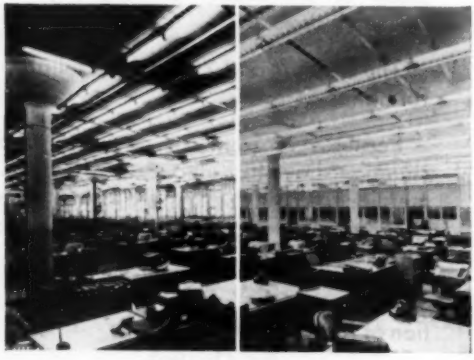
production facilities. Initial construction cost is said to be reduced as much as one-third in comparison to brick masonry construction.

The panels, developed as non-load bearing walls, employ laminated construction in which 1½ in. of rigid insulation separates two 1¾ in. concrete layers. A 4 x 4 in. No. 10 wire mesh is imbedded in each layer of concrete. The panels are cast in steel forms by a production line method, trucked to the job and put in place by cranes. Lifting hooks cast into the panels facilitate handling. Threaded metal inserts designed to receive connection bolts are imbedded near the top and bottom edges. Inserts cast in each panel, together with clip angles and clamps, provide adjustable and positive fastening devices. Tongue and groove joints insure water-tightness and act as a self-aligning medium. Rubber strips are cemented in the grooves, and after erection the joints are packed with oakum and calked. Cement mortar is used in horizontal joints to provide uniform bearing between panels. Steel frames support panels at every third course.

Concrete having a slump between 2½ and 3½ in. is made with high-early strength cements and ¾ in. maximum size aggregate. The concrete also has an air-entraining agent added at the mixer to produce 3½ to 4½ per cent entrained air. Results of 7-day tests for strength of the concrete have averaged 4300 psi.

Studebaker's Relighting Program Increases Level of Illumination Over 300 Per Cent

Level of illumination has been increased more than 300 per cent by a relighting program recently completed in the

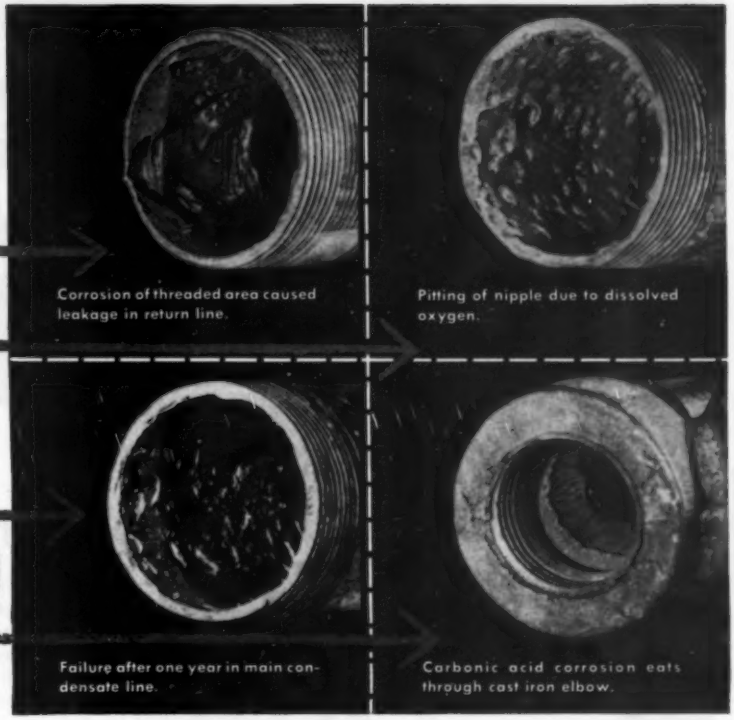


Purchasing Dept offices of the Studebaker Corp., South Bend, Ind. Before, as shown in the left-hand illustration, illumination level was 27 footcandles. The unshielded single-lamp fixtures were mounted above the sprinkler pipes and flush with the 14 ft ceiling.

The right half of the illustration depicts increased level of brightness after completion of the program. Installed

(Continued on page 116)

victims of Return Line Corrosion



Corrosion of threaded area caused leakage in return line.

Pitting of nipple due to dissolved oxygen.

Failure after one year in main condensate line.

Carbonic acid corrosion eats through cast iron elbow.

Dearborn Formula 702 will prevent Corrosion caused by low pH values

Excessively low pH values of water—caused by dissolved carbon dioxide—result in corrosion that destroys return line sections such as these.

The destruction of such valuable parts is easily and economically prevented with Dearborn Formula 702. Introduced directly into the boiler feed water, Formula 702 forms a continuous amine-type film on the return lines to effectively coat the lines against corrosion. In addition, Formula 702 will automatically repair any surface where the film has been broken by loosened rust scale, and also improve heat transfer in the line, thereby reducing the cost of steam production.

Your Dearborn Engineer will gladly demonstrate how you can reduce the cost of maintenance and avoid shutdowns with Dearborn Formula 702. Why not call him today?

DEARBORN CHEMICAL COMPANY

Merchandise Mart Plaza • Chicago 54, Illinois

BASIC PATENTS

Dearborn holds the basic patents (U.S.Pat. 2400543) for the use of filming amines for treating water.

YOU'LL WANT A COPY OF THIS BULLETIN Bulletin 5013, which outlines the causes of return line corrosion and the method of cure with Formula 702, will be sent on request.

Dearborn Chemical Company Dept. INP
Merchandise Mart Plaza
Chicago 54, Ill.

☐ Send a copy of Bulletin 5013
☐ Have a Dearborn Engineer call

Name.....

Position.....

Company.....

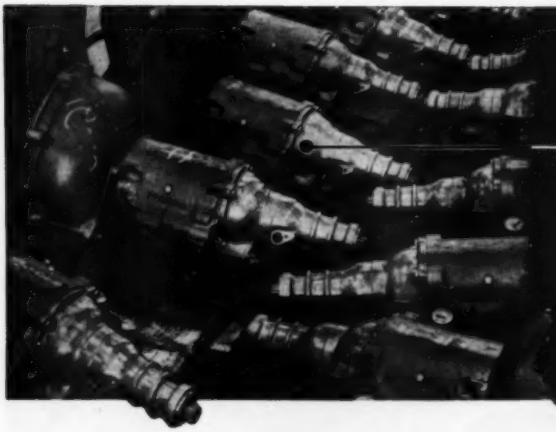
Address.....

City.....*Zone*.....*State*.....

Dearborn

TRADE MARK REGISTERED

THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES



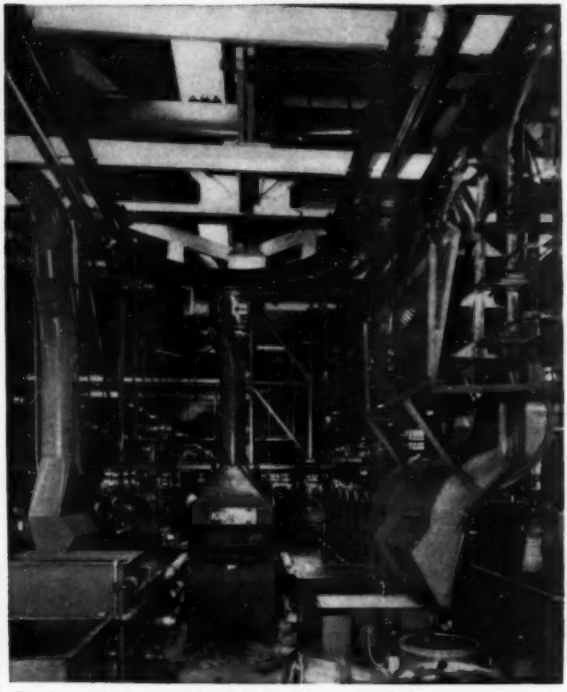
THE INVISIBLE TOOL

at work in the

FORD AUTOMATIC TRANSMISSION PLANT

NUMBER 4 OF A SERIES

KIRK AND BLUM Systems Remove Steam and Chemical Vapors in Cleaning



Cleaning tanks in the Finish Grinding Department of the Ford Automatic Transmission plant. These five tanks are fitted with KIRK & BLUM modified lateral cross draft hoods, which remove fumes below the operator's breathing level.

The fumes of chlorinated solvents as well as steam and water vapor from heated soak tanks and washing machines are controlled in this plant by KIRK & BLUM Systems. As shown here, a number of fume collecting points are piped to a ceiling-mounted fan which exhausts outside the plant. Make-up air is furnished by another KIRK & BLUM System.

In the ultra-modern Ford Motor Company Automatic Transmission Plant, 37 distinct KIRK & BLUM Systems aid in the production of Merc-o-Matic and Ford-o-Matic transmissions. In heat treating, quenching, welding, cleaning, machining, woodworking, maintenance and assembly operation, they provide "Clean Air . . . the INVISIBLE Tool" in this model plant.

Let the experience of KIRK & BLUM engineers work for you. Write for literature. The Kirk & Blum Manufacturing Co., 3174 Forrer St., Cincinnati 9, Ohio.

KIRK AND BLUM

FUME CONTROL SYSTEMS

"Our *Powermaster* Boilers are dependable, efficient, easy to service, and economical to operate"

William H. Wagner
Plant Engineer
Blue Bird Silk Mfg. Co.

Alfred J. Sidler
Plant Manager
Blue Bird Silk Mfg. Co.

20% Saving in Steam Cost at York, Pa. Manufacturing Plant

William H. Wagner, Plant Engineer of the Blue Bird Silk Manufacturing Company, knows the problems of generating high pressure steam 24 hours a day, 365 days a year. And he knows how serious it can be for a busy manufacturing plant if there is trouble or failure in the boiler room. That's why, two years ago, the company replaced their old-fashioned coal-fired boilers with two 200 h.p. POWERMASTER packaged automatic boilers, burning #6 (Bunker C) oil. Here is what they found:

- The cost of producing steam for processing and heating dropped 20%.
- The steam produced now is much dryer.
- The POWERMASTERS respond very rapidly to variations in load.
- Maintenance has been negligible.

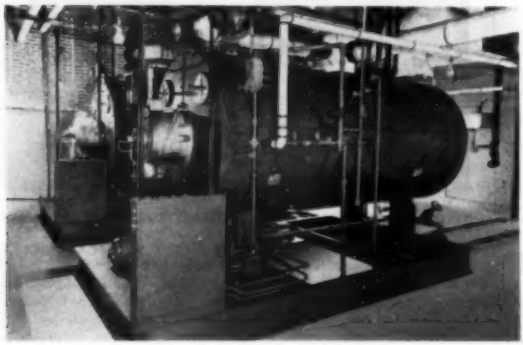
Little wonder that Alfred J. Sidler, Plant Manager, says, "If we had it to do over again, we would certainly buy POWERMASTERS."

No other packaged automatic boiler gives you *all 3 advantages of the Powermaster:*

1. SAVE FUEL—because the special *Powermaster* burner design gives you top efficiency when operating anywhere between 30% and 100% of capacity.
2. SAVE IN MAINTENANCE and clean-up time. Complete combustion of fuel gives practically smokeless and carbon-free operation. The burner has *no* moving parts to wear out . . . or to be cleaned daily.
3. CHANGE FROM OIL TO GAS (or gas to oil) in just a few minutes. Burn light oil, heavy oil, or gas—whichever is cheaper. You no longer need depend on one source of fuel supply.

Write for this Catalog

To get complete information about this modern packaged automatic boiler for steam or hot water, write for *Powermaster* Bulletin 1218. We'll be glad to put a copy in the mail for you.



These 200 h.p. POWERMASTER packaged automatic boilers have been operating round-the-clock for more than two years at the Blue Bird Silk Manufacturing Company, York, Pa. Burning #6 oil, they produce a total of 13,800 pounds of steam per hour.

Powermaster®

PACKAGED AUTOMATIC BOILERS

In sizes to 500 h.p.; pressures to 250 psi.

ORR & SEMBOWER, INC.

Established 1885

950 Morgantown Road, Reading, Pa.

WING AUXILIARY TURBINES

OPERATING RANGES

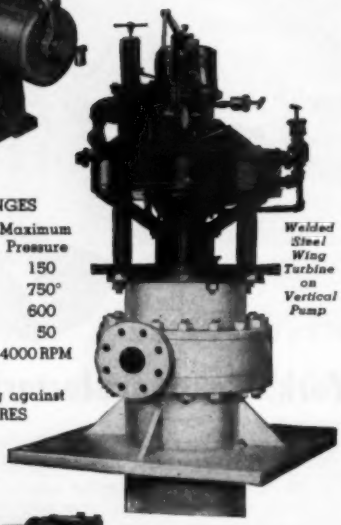
	Standard	Maximum Pressure
Horsepowers	100	150
Temperatures	525°	750°
Pressures	275	600
Back Pressures	50	50
Speeds	4000 RPM	4000 RPM

Capable of exhausting against HIGH BACK PRESSURES

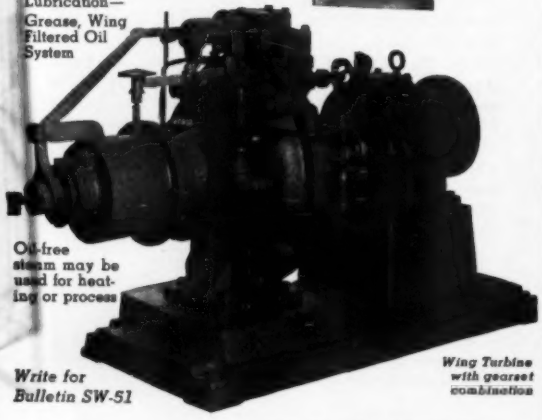
Shafts—Horizontal or vertical

Rotation—Clockwise or counter-clockwise

Lubrication—Grease, Wing Filtered Oil System



Welded Steel Wing Turbine on Vertical Pump



Oil-free steam may be used for heating or process

Write for Bulletin SW-51

Wing Turbine with gearset combination

L. J. Wing Mfg. Co. 139 Vreeland Mills Rd. Linden, New Jersey

Factories: Linden, N. J., Montreal, Canada

Wing AUXILIARY STEAM TURBINES

Spot news

(Continued from page 112)

and planned by Colip Brothers, electrical contractors and lighting engineers of Sylvania Electric Products Inc., the new fixtures and lamps increased illumination to 102 foot-candles on desk surfaces. The room, measuring 312 x 72 ft, now has 997 fixtures mounted by chain suspension 11 ft above the floor. Each four foot fixture, equipped with translucent plastic side panels, uses two 40 w fluorescent lamps. They are mounted in continuous rows, 6 ft between rows. The entire installation consumes 99.7 kw.

Titanium is Produced at Former Magnesium Plant in Nevada

Titanium, a metal half as light as steel and about twice as strong, is now in limited production at The Titanium Metals Corporation of America, Henderson, Nev. A portion of a former magnesium plant, built during World War II, is being rehabilitated to expand the production of this non-corrosive, heat-resistant metal to 3600 ton annually—a goal expected to be reached before the end of this year. Contracts for engineering and construction were awarded to The H. K. Ferguson Co.

—*End*

TWENTY-TWO YEAR OLD GENERATOR—GOOD AS NEW

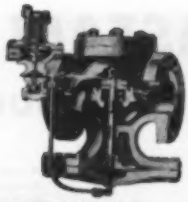
No. 9 has been one of Wisconsin Electric Power Company's non-complaining stalwarts for 22 years. Located in the Lakeside Station, Milwaukee, this 70,600 kva, 13,800 v, 1800 rpm generator was placed in operation in 1929. A Westinghouse Engineering and Service engineer is shown inspecting the stator winding—part of periodic inspection procedure

Looks like we're using **SPENCE REGULATORS** *all over our plant*

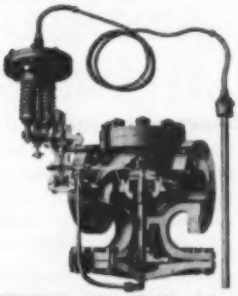
This busy plant has ordered and re-ordered Spence Regulators for two good reasons. (1) Spence offers a *wide-range line* to handle a host of regulating jobs. (2) What's more, Spence units give accurate service year after year. Maintenance is negligible. Over-all costs are low. These design features explain why . . .

- **Single Seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**

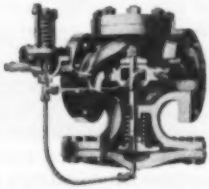
Write for Bulletin 350 for complete details on Spence's line of automatic regulating valves.



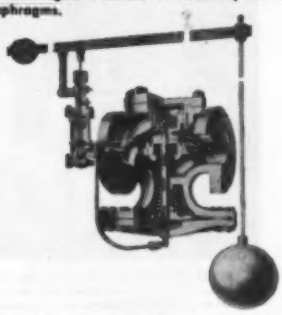
PRESSURE REDUCING—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes ¼ in. to 12 in. Pressures to 600 psi 750F.



TEMPERATURE REGULATING — Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.



BACK PRESSURE CONTROL—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphragms.



LEVER OPERATED—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

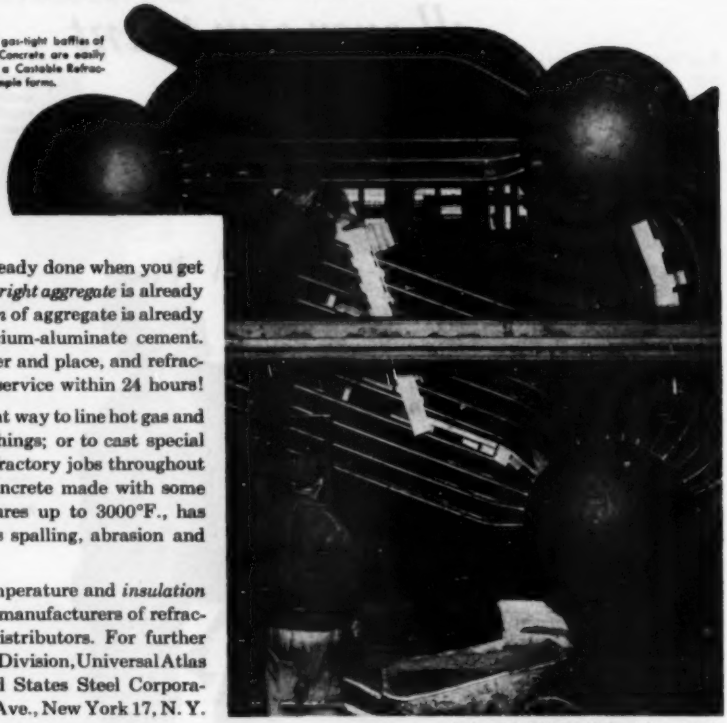
SE 110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence

CASTABLES give you a head start on your next Refractory job

Monolithic, gas-tight baffles of Refractory Concrete are easily made with a Castable Refractory and simple forms.

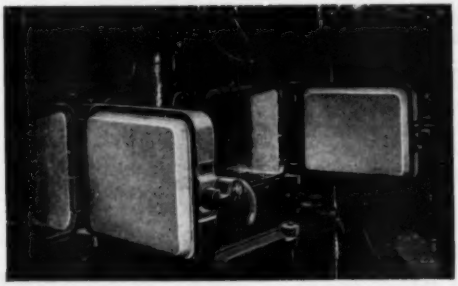


TWO PARTS OF THE JOB are already done when you get Castable Refractories. The *right aggregate* is already selected. The *right gradation* of aggregate is already mixed with Lumnite* calcium-aluminate cement. All you do is mix with water and place, and refractory concrete is ready for service within 24 hours!

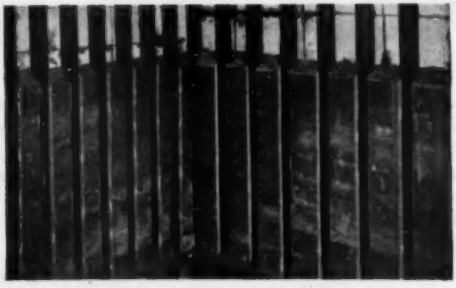
That's the fast, convenient way to line hot gas and air ducts, stacks and breechings; or to cast special shapes... and do many refractory jobs throughout your plant. Refractory Concrete made with some Castables takes temperatures up to 3000°F., has low volume change, resists spalling, abrasion and corrosion.

CASTABLES to meet specific temperature and *insulation* requirements are made by manufacturers of refractories and sold by their distributors. For further information, write Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Ave., New York 17, N. Y.

Packaged Castables used in these jobs were made by Mexico Refractories Company, Mexico, Mo.



DOOR LININGS made with adaptable Castable Refractory Concrete. Unnecessary to stock large inventories of special shapes. Instead, special shapes can be cast in place or poured in molds as needed. Volume change is negligible.



TUBE PROTECTING Water Wall Studding made with a Castable Refractory is tough and highly radiant, uses a different aggregate than baffles (above). With Castables you get Refractory Concrete tailor-made for the job.

*"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.

IP-L-9999

ATLAS® **LUMNITE for INDUSTRIAL CONCRETES**

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—September to June*

Corrosion of piping in steam and condensate return lines is an expensive two-way headache. (1) It leads to large outlays for pipe replacement and maintenance. (2) It often results in plugged return lines and traps due to the solid products of corrosion. Bird-Archer Amine Treatment effectively eliminates these troubles at low cost.

Here's how. Amines are fed into the boiler or into the steam and condensate systems. The amines raise the pH value of the condensate and also tend to inhibit equipment-destroying corrosion through surface protection of the metal itself. In scores of plants, this Bird-Archer system has more than paid for itself by substantially cutting replacement and maintenance costs.

Bulletin CP 100 gives all the facts on Bird-Archer Amine Treatment. Write for your copy.

BIRD-ARCHER
WATER TREATMENT

THE BIRD-ARCHER COMPANY, 4337 NORTH AMERICAN ST., PHILADELPHIA 40, PA.
NEW YORK • CHICAGO

IN CANADA: The Bird-Archer Co., Limited, Cobourg, Ontario
In Mexico: Calderas y Accesorios, S.A., Amsterdam 291, Mexico, D.F

BA 106

News
of men and companies

AWARDS

Westinghouse Electric Corp.—Two engineers of the Switchgear Div. recently won a joint award of $10,000 for invention of the Multi-flow De-ion circuit breaker. They are Dr. W. M. Leeds, mgr of the engineering design section, and B. P. Baker, advisory engineer at the East Pittsburgh plant. Each received a check for $5,000. E. F. Miller, Steam Div. engineer, has been awarded a check for $5,000 for his invention of a gas turbine combustor that made possible long-life operation of aircraft jet engines.

ANNOUNCEMENTS

The American Brass Co.—John A. Coe, pres, predicted that "the copper supply situation would continue to improve—barring work stoppages." His statement was issued at the formal opening ceremonies of the company's $1½ million copper and brass warehouse, 4501 W. North Ave., Chicago.

General Electric Co.—Is supplying approximately $800,000 worth of electrical equipment for the Lehigh Portland Cement Co.'s new two-kiln plant near Jacksonville, Fla.

The Green Fuel Economizer Co., Inc.—Has added Aerodyne dust collectors to its line of products by acquiring U. S. patent rights from the Aerodyne Atlantic Corp. of New York, N. Y. Sales and distribution will be made by the Aerodyne Div. of The Green Fuel Economizer Co., Inc., through its sales organization.

Perfect Circle Corp.—Purchases the entire stock holdings of Centrifugal Foundry Co., Muskegon, Mich. W. B. Prosser, Perfect Circle v-p and genl mgr heads the Muskegon organization as pres. Formerly pres and genl mgr of Centrifugal Foundry, A. G. Anderson is v-p and genl mgr.

Westinghouse Electric Corp.—Has been awarded a $278,000 contract for the major electrical equipment to be used on a petroleum products pipeline now being reconstructed by the Tuscarora Oil Company, Ltd. to transport refined oil products across Pennsylvania. The equipment, featuring centralized semi-automatic control, will be used at pumping stations located near Allentown, Harrisburg and Altoona.

Wheelco Instruments Co.—It was announced that Barber-Colman Co. will purchase the principal assets of Wheelco Instruments Co. Present plans are to continue current operations in Chicago until such time as manufacturing facilities can be gradually transferred to Rockford. No changes are contemplated in Wheelco's national sales and service organization.

Worthington Corp.—Stockholders of Worthington Pump and Machinery Corporation at their annual meeting, re-elected their present board of directors and voted to change the company's name to Worthington Corporation. It is stated that no corporation policies or practices will be affected in any way by the name change.

York Corp.—Received an order valued at approximately $435,000 to air condition two buildings of the Consolidated Vultee Aircraft Corp. at Pomona, Calif.

SALES OFFICES

Sterling Electric Motors, Inc.—B. G. Jordan heads the new sales office located at 319 Castle Blvd., Tulsa, Okla. Opening of a new sales office in Buffalo, N. Y., located at 63 Liston Road, is announced. J. W. Byrnes is mgr.

INDUSTRIAL ELECTRIFICATION COUNCIL FORMED

Formation of the Industrial Electrification Council was announced by J. R. Hartman, chairman of its executive committee, and M. E. Skinner, chairman of the commercial div general committee of the Edison Electric Institute.

The purpose of the Council is to foster and coordinate the dissemination to American industry of factual information on the application of electricity and electrical apparatus to industrial processes and other manufacturing operations.

Its formation resulted from a feeling that greater overall good would result if the various educational and promotional programs heretofore carried on by the individual companies were coordinated and supplemented, in cooperation with an agency equally concerned with the interests of all.

Because of the breadth and complexity of the field of industrial electrification, the Council is restricting its initial operations to industrial electric heating.

Membership will be open to all operating electric utility companies and all manufacturers of industrial electrical equipment. Headquarters office is located at 420 Lexington Ave., New York 17.

Corning Glass Works—Opens new sales district office in Washington, D. C., and appoints C. L. Day as mgr. The office is located in Room 616, Kass Bldg., 711 14th St., N.W.

Ward Leonard Electric Co.—The Los Angeles branch office and warehouse are now located at 1605 E. Olympic Blvd., Los Angeles 21, Calif. The office is managed by H. S. Eales.

SOCIETIES

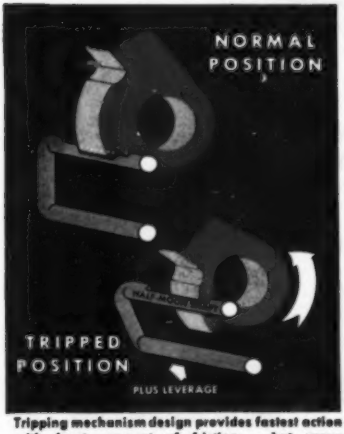
American Society of Mechanical Engineers—I. M. Stein, executive v-p of Leeds & Northrup Co., has been elevated to the grade of Fellow. D. R. Yarnall, past president of the society, presented the certificate of award.

(Continued on page 123)

Material handling equipment manufacturers and users discuss bulk handling problems

Participants in the recent Material Handling Institute conference on "Better Methods of Handling Dry Materials in Bulk" were (left to right, center table) L. W. Shea, pres, MHI; A. K. Strong, American Cyanamid Co.; L. G. Weller, Fuller Co.; C. Lord, United States Steel Co.; S. M. Mercier, Jeffrey Manufacturing Co.; C. D. Gabor, Harbison-Walker Refractories; F. Sherriff, Clark Equipment Co.; E. L. Heidenreich, Jr., Designing Engineers; O. W. Werner, Link-Belt Co.; (standing) E. R. Lutz, Atlas Powder Co.; H. H. Hall, Aluminum Company of America; F. J. Schmidt, American Steel Dredge Co., Inc.; A. B. Crichton, Jr., Johnstown Coal and Coke Co.; E. W. Franz, May-Fran Engineering Co.; A. D. Sinden, Stephens-Adamson Manufacturing Co.; M. C. Down, New York Trap Rock Corp.; R. F. Wikoff, The Thew Shovel Co.; B. R. Carter, MHI Staff.

Trust yourself to this test... only with HEINEMANN CIRCUIT BREAKERS



Tripping mechanism design provides fastest action with least amount of friction . . . but never nuisance tripping. HEINEMANN Circuit Breakers have no confusing "reset" position . . . only "On" and "Off." After tripping, this can be turned "On" immediately if the fault has been corrected.

This man is holding a short circuit in his bare fingers. He might receive a bad burn . . . except that this circuit is protected by HEINEMANN Circuit Breakers.

With slower circuit protection, wires heat, insulation breaks down . . . and service troubles get their start. However, HEINEMANN Circuit Breakers don't use heat for actuation . . . they have no thermal elements. On short circuits, tripping is always instantaneous, in fact, so fast that wires in motor windings and other equipment are completely safe. On momentary overloads a proportioned time delay is provided . . . being shorter for large overloads . . . and longer for small ones.

Performance to this extent explains why most equipment manufacturers use HEINEMANN Circuit Breakers in their products.

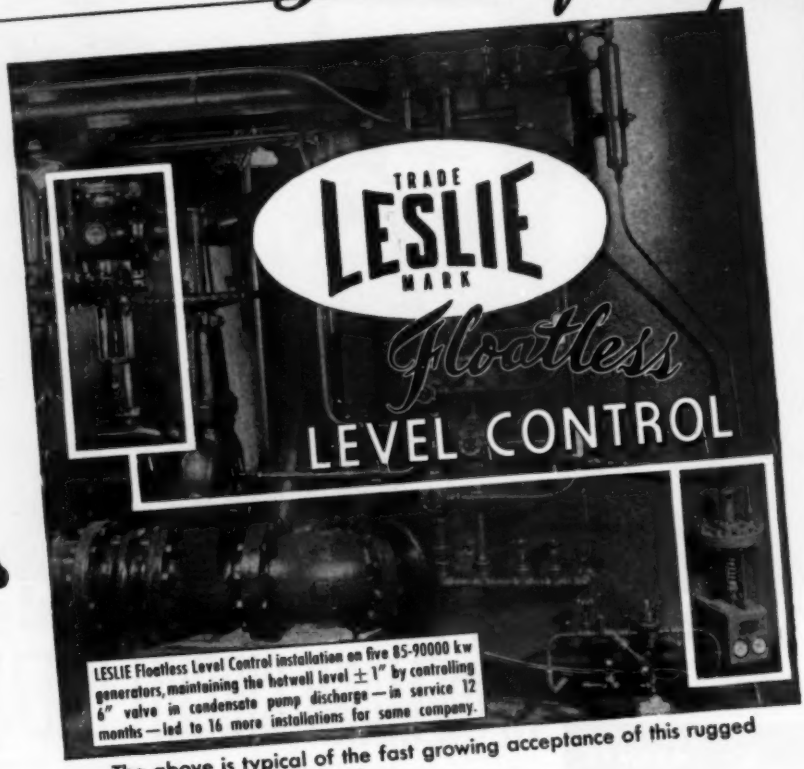
Send for complete literature. HEINEMANN ELECTRIC COMPANY, 140 Plum Street, Trenton 2, N.J.

don't use heat... USE POWER

HEINEMANN Circuit Breakers . . One, two and three pole . . 10 milliamps to 100 amperes

HEINEMANN Circuit breakers

An Outstanding Record of Acceptance!



LESLIE Floatless Level Control installation on five 85-90000 kw generators, maintaining the hotwell level ± 1" by controlling 6" valve in condensate pump discharge — in service 12 months — led to 16 more installations for same company.

The above is typical of the fast growing acceptance of this rugged and accurate level control.

ADVANTAGES

- EASY TO INSTALL
- ACCURATE REGULATION (± 1" Water Column)
- NO FLOATS, STUFFING BOXES, ETC.
- MULTI-MEDIUM ACTUATED
- DIAPHRAGM PRESSURE ELEMENT
- ACTION REVERSIBLE

Applications: On open and pressurized vessels, including boilers, tanks, evaporators, heaters, standpipes, etc.

PRINTED IN U.S.A.

SEND for illustrated Bulletin

Look for LESLIE Regulators under "Valves" or "Regulators" in your Classified Telephone Directory in leading industrial cities where LESLIE factory-trained engineers are located.

LESLIE CO., 263 Grant Avenue, Lyndhurst, New Jersey

1627

PRESSURE REDUCING VALVES • PRESSURE CONTROLLERS • FLOATLESS LEVEL CONTROLS
PUMP GOVERNORS • TEMPERATURE REGULATORS
SELF CLEANING STRAINERS • AIR HORNS • STEAM WHISTLES

News
of men and companies

(Continued from page 120)

NEW REPRESENTATIVES

Cleaver-Brooks Co.—Announces the appointment of the Dyke & Tutsch Co. of 3253 North Green Bay Ave., Milwaukee, Wis., as a manufacturer's representative for the sale of Cleaver-Brooks boiler equipment.

Cornish Wire Co.—The Wood & Anderson Co., 3001 Delmar Blvd., St. Louis, Mo., is appointed to handle distribution in Missouri, Kansas and Southern Illinois.

Republic Rubber Div.—The John Bouchard & Sons Co., 1024 Harrison St., Nashville, Tenn., is appointed an accredited distributor of this div of Lee Rubber & Tire Corp.

Rust-Oleum Corp.—Announces addition of five industrial distributors to its distributor sales organization. The new firms are: The Adkins Co., Baltimore Ave., Berlin, Md.; Mill and Contractors Supply Co., 121-3 Water St., Wilmington, N. C.; The Warren Hardware Co., 183 West Market St., Warren, Ohio; American Radiator and Standard Supply Corp., 130 North 3rd St., Zanesville, Ohio; and Couch and Heyle, 1016 South Adams, Peoria, Ill.

APPOINTMENTS

Graver Tank & Mfg. Co., Inc.—Announces that at a recent directors meeting, the mgr of sales, W. M. Broxham, was named v-p in charge of sales. Lt. Col. H. C. Conners, former mgr of the Chicago div, presently Director of

W. M. Broxham Lt. Col. H. C. Conners

Combat Operations of the 315th Air Division (Combat Cargo), was recently awarded senior paratrooper wings by the 187th Regimental Combat Team after completing his 30th required jump. Conners is believed to be the first U. S. Air Force officer to have qualified as a senior parachutist.

E. F. Drew & Co., Inc.—The Power Chemicals Div. announces that F. W. Brown has joined their organization. Also announces the following changes in the technical dept: J. S. Beecher has been placed in charge of proposals and genl technical work; C. Clodi will be directly in charge of the water laboratory and in addition will assist Beecher.

(Continued on page 124)

PROCESSING
STEAM
at LOWER COST

- BECAUSE:
- fuel savings of from 20% to 50%
- full operating pressure in 5 minutes from a cold start
- instant recovery to meet any pea demand within rated capacity
- simple, safe and foolproof cont of feedwater and fuel
- no expensive standby ses
- low installation cost er or pump to inst stack or access
- less spa per hor

To learn how this 50 h. p. Clayton Forced Recirculation Steam Generator reduced steam production costs by 70% . MAIL THE COUPON

Send name of nearest distributor and arrange desk demonstration of Clayton *Forced Recirculation* principle. Send catalog. IP-5

NAME_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

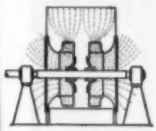
Animated flow chart shows how *Forced Recirculation* principle cuts steam costs.

Clayton MANUFACTURING COMPANY
BOX 550, EL MONTE, CALIFORNIA

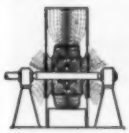
ANOTHER pd DEVELOPMENT

Gives you GREATER CONVERSION

OF VELOCITY PRESSURE TO STATIC PRESSURE



How P-D split wheel assists diffusion—aids distribution throughout the fan.

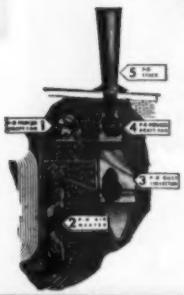


Conventional double wheel with common disc produces concentration, results in poor diffusion.

Performance ratings of the Prat-Daniel F-D Fan are established according to the Standard Test Codes adopted by N.A.F.M. and the A.S.H.V.E.

Design characteristics provide unusually high conversion of Velocity Pressure to Static Pressure. This is accomplished by streamlined inlet cones that are larger in proportion to the wheel than are usually found in forced draft fans. The unusual depth of the cones provide a wider housing than would customarily be used, increasing the space available for diffusion. Precisely fashioned backward curved blades provide a nearly perfect aerodynamic flow across both leading and trailing edges. Double wheel fans are spaced apart to permit four way diffusion of air, further contributing to this conversion. Peak efficiency and horsepower curves fall well within normal fan selection range, offering the optimum in maximum efficiency and non-overloading characteristics.

These are all carefully researched features that have made the Prat-Daniel F-D Fan a highly efficient apparatus. Check these features before you decide on your next fan. Write for catalog No. 300 today.



UNIT RESPONSIBILITY

The Thermix Corp., project engineers for the Prat-Daniel Corp., offer all components required for the handling of air and gas: (1) P-D Forced Draft Fans; (2) P-D Air Pre-Heaters; (3) P-D Tubular Dust Collectors; (4) P-D Induced Draft Fans; and (5) P-D Fan Stacks. This unit responsibility, by a well known firm, relieves the engineer of the necessity of integrating equipment from various sources into the over-all project.

Sales and Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

Canadian Affiliates: T. C. CHOWN, LTD.
1440 St. Catherine St. W., Montreal 25, Quebec
50 Abell St., Toronto 3, Ontario

Designers and Manufacturers

PRAT-DANIEL CORPORATION

SOUTH NORWALK, CONN.

News

of men and companies

(Continued from page 123)

EXPANSIONS

Aluminum Company of America—Immediate plans, which call for extensive modernization and revision of the ingot casting facilities at Alcoa's Vancouver (Wash.) Works, are announced. Cost of the expansion will be $1,217,500.

BullDog Electric Products Co.—Announces it has acquired additional manufacturing facilities in Detroit. The plant of 53,000 sq ft is located at 547 Harper Ave. J. Muic will be production mgr for the Harper plant and will also supervise the nearby Piquette plant.

Ford Motor Co.—Has engaged The Kuljian Corp. to design, engineer and construct new facilities for their No. 1 power plant at River Rouge. This new project includes removal and replacement of three medium pressure boilers with three new boilers each with 600,000 lb per hr continuous steam capacity.

The Rust Engineering Co.—Will install a new high pressure boiler at Weirton, W. Va., for Weirton Steel Co. Designed for a steam capacity of 350,000 lb per hr at a normal rating of 850 psi, the new unit will be equipped to burn blast furnace gas primarily, with provisions for firing with pulverized fuel and coke oven gas as well. In addition to the boiler, Rust has already begun work on a blower house and auxiliary equipment for a turboblower which will serve the new No. 4 blast furnace at Weirton.

APPOINTMENTS

The Permutit Co.—A. P. Super joins the organization as research engineer, assigned to the special applications dept.

A. P. Super

A. W. Keen

Sylvania Electric Products, Inc.—A. W. Keen is named mgr of application coordination. He formerly was asst to the mgr of the product development laboratory. The appointment of D. F. King as east central district sales mgr of the parts div is announced, with headquarters in the district sales offices, Terrace Plaza Bldg, Cincinnati, Ohio.

Fageol Heat Machine Co.—Appoints R. H. Randolph as genl sales director.

(Continued on page 126)

These fellows like dirt

...how about your boilers?

Hogs thrive on dirt—dirt of any kind, wet or dry. But your boilers are different; they can't function at their best with coal that isn't properly cleaned and correctly sized for their particular requirements. And steam costs are bound to go up if you try to use coal that isn't *right* for your burning equipment.

Here's how you can get the *right* coal—from Bell & Zoller: Our combustion engineer will inspect your steam-producing equipment and analyze your requirements to determine *exactly* what is needed. Then, from Bell & Zoller's wide selection of top-quality Southern Illinois, Western Kentucky and West Virginia coals, he will specify the *right* coal, properly cleaned and correctly sized for your needs.

So, if your boilers are "hogging" coal, and steam costs are a problem, call or write our nearest office. A Bell & Zoller combustion engineer will gladly arrange an immediate consultation entirely without obligation on your part.

BELL & ZOLLER COAL COMPANY

BELL BUILDING, CHICAGO 1, ILLINOIS

ST. LOUIS • NASHVILLE • OMAHA • MINNEAPOLIS

Sixty-Six Years of Service to Coal Users

Producers of
ZEIGLER, MOSS HILL, ORIOLE, MURDOCK, and BUCKHORN Coals

Sales Agents for
Otter Creek Coal Company
Lockwood, West Virginia

Spring Hill Mining Company
Terre Haute, Indiana

Boone County Coal Corporation
Sharples, West Virginia

RESEAT VALVES
AND BIBBS
IN PLACE
QUICKLY
ACCURATELY
RESEATING A BIBB
RESEATING A VALVE
PAYS FOR ITSELF ON FIRST 2 OR 3 JOBS!
Don't junk expensive globe or angle valves, bibbs, fixtures – reseat them! Order Skinner Valve and Bibb Reseater. Easy to use. Guaranteed cutters leave seat glass-smooth, level, tight.
1/4" to 2" $28.75
1/4" to 3" $40.80
M. B. SKINNER CO.
SOUTH BEND 21, INDIANA, U.S.A.

News

of men and companies

(Continued from page 124)

Allis-Chalmers Manufacturing Co.—J. D. Greensward is appointed mgr of the newly-organized apparatus dept. He continues as genl mgr of the Norwood Works. The new setup also makes the Texrope drive and pump depts, under the continuing management of T. C. Knudsen and H. P. Binder, respectively, sections of the appartus dept. W. F. Dueringer is named engineer-in-charge of sales of the steam turbine section. Formerly supervisor of sales of units 15,000 kw and larger, he is succeeded in that position by C. R. Bloom, an application engineer in the steam turbine section. Appointments of J. T. Donovan as supervisor of sales for steam turbine-generator units below 15,000 kw and D. J. Nairn as supervisor of sales for marine and navy turbine equipment are also announced.

Manning, Maxwell & Moore, Inc.—M. S. Palmer becomes mgr of field sales and R. F. Attner, succeeding Palmer, is valves product mgr.

Metals Disintegrating Co.—Reelection of H. E. Hall as pres is announced.

National Electric Products Corp.—A new sales and service dept, together with a series of advancements within the national sales structure, is announced. V. P. Oatis, Jr., is named industrial sales mgr in full charge of sales and service on National Electric's Busway, Nepcoduct, Wide Range Connectors, Planeduct, Industrial Underfloorduct, Terminal Blocks and Junction Boxes. W. A. Mallory is appointed asst industrial sales mgr in charge of Busway and related products, while G. E. Placier, Jr., recently transferred to

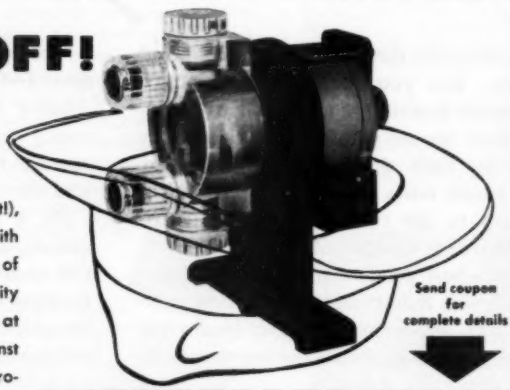
V. P. Oatis, Jr. **W. A. Mallory**

Pittsburgh from the Cincinnati sales office, is named asst industrial sales mgr in charge of Nepcoduct and Planeduct. All three will have their headquarters at the home office. It is also announced that J. M. Morgan has been assigned to the home office service dept on Busway and related products, and R. Huckestein similarly assigned on Nepcoduct and Planeduct.

(Continued on page 128)

HATS OFF!

...TO THIS LITTLE PROPORTIONING PUMP



Despite its small size (it would fit in your hat!), %Proportioneers% MICRO-SHOT is loaded with big advantages for the proportionate pumping of chemical solutions. This is a low cost, low capacity metering pump designed for delivering liquids at controlled rates up to 2 gallons per hour against pressures to 50 pounds per square inch. Micro-Shot is furnished as a complete "Package", including an electric or hydraulic control mechanism together with the necessary tools and instructions for installation, operation, and maintenance.

Micro-Shot is ideal for dependably feeding all the more common corrosive chemical solutions at very low rates. The "See-Thru" pumping head is of thermoplastic resin, permitting observation of diaphragm and valves while the pump is working. A calibrated indicator permits ready selection of feed rate while pump is in operation.

%PROPORTIONEERS, INC.%
357 Harris Avenue, Providence 1, Rhode Island

Please send Bulletin 1923 describing %Proportioneers% Micro-Shot.

Name.....

Company.....

Street.....

City.....State.....

TERRY

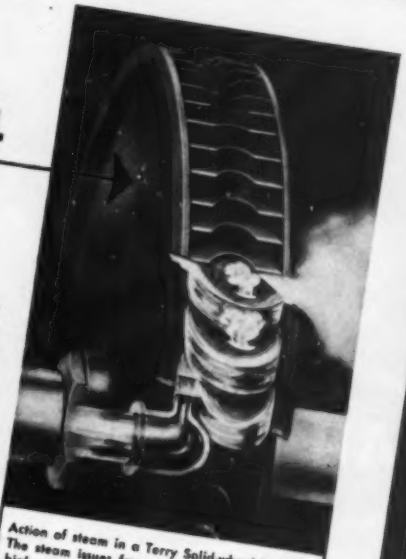
THIS TURBINE WHEEL

has no parts to loosen or work out

The rotor of the Terry Solid-wheel Turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to become loose or work out.

The power-producing action of the steam takes place on the curved surfaces at the back of the buckets. Hence, wear of the blades is of little consequence, as it does not materially affect horsepower or efficiency. There is practically no end thrust since the steam enters and leaves the wheel in a direction at right angles to shaft.

This is only a small part of the story of the many advantages of the Terry Solid-wheel Turbine. Write for complete details.



Action of steam in a Terry Solid-wheel Turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket where its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.

THE TERRY STEAM TURBINE CO.

TERRY SQUARE, HARTFORD 1, CONN.

TT-1189

Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

SAVE TIME WITH ARROW · HART
STRAIGHT-THRU WIRING

ARROW AH HART

TYPE "RA" MOTOR STARTERS

Stay ahead of tough installation and maintenance schedules. Arrow-Hart's revolutionary straight-thru front wiring can save time, work and space up to 30%. This simple, versatile new system eliminates looping, U-bending and many other time and money consuming operations necessary with the "scrambled wiring" of conventional type starters. Straight-thru wiring means safer direct routing with greater separation of line and load, easy circuit identification and elimination of load terminal on line side. Installation and servicing are easier and quicker.

There's an "RA" starter for every job requirement; sizes 0-1-2-3-4 in NEMA Type I, IV, V, VII, and IX housings available. The Right Angle operating mechanism assures dependable operation and superior protection. Small size (½ that of conventional starters) means new opportunities for more compact and convenient control panel layouts.

WRITE FOR THIS FREE BOOKLET
Here's real help in planning your starter installations. This fully illustrated booklet contains complete engineering data, operating features, dimensions and ratings for the entire "RA" line. Send for your copy TODAY.

AH HART

THE ARROW-HART & HEGEMAN ELECTRIC CO.

ARROW·HART

INDUSTRIAL CONTROL DIVISION
1205 HAWTHORN ST., HARTFORD 6, CONN.

News
of men and companies

(Continued from page 126)

The Babcock & Wilcox Co.—Announces election of P. H. Forbes as comptroller and appointment of R. J. Cantwell, N. K. Feldman and R. D. Wing as asst comptrollers.

Graton & Knight Co.—At the recent directors' meeting, D. S. Williams was elected pres succeeding his father, A. A. Williams, who is chairman of the board. Appointment of A. Reikes, to succeed J. N. Daniels who resigned, as mgr of the San Francisco branch is announced.

D. S. Williams **E. Estoclet**

York-Shipley, Inc.—E. Estoclet, a veteran genl contractor, builder, and engineer, has been appointed regional mgr of the industrial div for eight eastern states. His appointment is part of the program to extend distribution of Steam-Pak generators and York-Power industrial burners.

Cleaver-Brooks Co.—H. F. Holtz, former advertising and marketing mgr, is named sales mgr of the Boiler Div. succeeding R. J. Tutsch who resigned. W. L. Nahin is appointed sales mgr of the Distillation Div.

Link-Belt Co.—At the recent directors' meeting R. C. Becherer was elected pres to succeed G. P. Torrence, who is retiring from active service in accordance with the company's retirement plan. All other officers were reelected.

R. C. Becherer

Owens-Illinois Glass Co.—J. Duncan, Jr. is appointed to the newly-created post of director of trade relations for the Kaylo Div.

Standard Pressed Steel Co.—J. V. Lester, controller for the last five years, was elected treas at the recent annual meeting. Other officers were re-elected. They are H. T. Hallowell, chairman of the board; H. T. Hallowell, Jr., pres; J. W. Friel, v-p, and W. I. Kryder, secy. H. F. Gade, senior v-p and treas, retired after 49 years service.

—End

AFTERCOOLING

Another Example of Efficient Power at Lower Cost

a dividend in extra power for users of Cooper-Bessemer supercharged diesels

• Yes, if you are operating a supercharged Cooper-Bessemer diesel, you're in line for Cooper-Bessemer aftercooling — a sure-fire way to increase your horsepower approximately 15%.

It involves only a simple, surprisingly inexpensive modification. No change in engine speed, space requirements, jacket water cooling system or overload capacity. The aftercooler is readily inserted between the supercharger and intake manifold. Here the combustion air is watercooled, resulting in greater power and higher combustion efficiency.

If you can use additional power to advantage, here's a simple, inexpensive way to get it — another typical example of progressive engineering at Cooper-Bessemer. Why not talk it over with our nearest office?

New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis Los Angeles Chicago Caracas, Venezuela Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Gloucester, Mass. New Orleans, La.

The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

HERE'S YOUR *Complete* STEAM PLANT

- One purchase, backed by undivided responsibility.
- Shipped completely assembled after factory tests to assure highest operating efficiency.
- More than 80% thermal efficiency guaranteed.
- 4-pass design provides 5 sq. ft. of heating surface per b.h.p.
- Induced draft fans which are built-in eliminate the need of an expensive chimney.
- Simple installation requires no special foundation.
- Clean, quiet operation.
- Heavy-duty, rugged construction assures long-lived dependability.
- Burner equipment to suit your fuel: gas, oil or both.
- 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i., or for hot water heating.
- For complete details, write today for catalog 402.

SUPERIOR STEAM GENERATORS

SUPERIOR COMBUSTION INDUSTRIES, Inc.

Factory: Emmaus, Pa.

Executive Offices: Times Building, Times Square, New York 18, N. Y.

3 *special departments featured monthly to give you FREE bulletins, catalogs and product data screened for your personal interest in*

ENGINEERED PLANT SERVICES

1. NEW EQUIPMENT

Begins on page 8

Contains highlights of new products by leading manufacturers, briefed and illustrated for your easy reference. Complete data on each of these products are available ***free.***

2. NEW BULLETINS

Begins on page 144

Includes descriptions of only those bulletins and catalogs that are really ***new*** and of ***direct value*** to you — saves your reading time, yet gives you full service. All bulletins sent to you ***free*** on request.

3. READERS GUIDE TO ADVERTISED PRODUCTS

Begins on page 133

Designed to catalog advertised products for your convenience in finding the ads which are of special interest to you at this time. Also lists those important bulletins, catalogs and working data offered ***free*** in the advertisements.

REQUEST CARD FOR LITERATURE OR MORE INFORMATION—May, 1952

To: INDUSTRY AND POWER, St. Joseph, Mich. Please have forwarded to me, at no obligation, the literature I've indicated by the following key numbers:

New Equipment begins Page 8	*New Bulletins begins Page 144*	*Advertised Products begins Page 133*
No's	No's	No's

Your Name_____ Title_____

Your Company_____

Co. Address (St. & No.)_____

City_____ State_____

Inquiries for items listed in this issue not serviced beyond September 1, 1952

FIRST CLASS
PERMIT No. 19
(Sec. 34.9, P.L.&R.)
ST. JOSEPH, MICH.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

3¢—POSTAGE WILL BE PAID BY

INDUSTRY AND POWER

420 MAIN STREET

ST. JOSEPH, MICH.

3 *special departments featured monthly to give you FREE bulletins, catalogs and product data screened for your personal interest in*

ENGINEERED PLANT SERVICES

1. NEW EQUIPMENT

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No's_____	No's_____	No's_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Your Name_____ **Title**_____

Your Company_____

Co. Address (St. & No.)_____

City_____ **State**_____

Inquiries for items listed in this issue not serviced beyond September 1, 1952

Readers' guide to advertised products

This department is both a product index for advertising and a keyed listing for advertised literature. Refer to advertisement on page indicated and contact advertiser directly—or list paragraph key numbers on reader service card (page 131) to get data you want

AIR & DUST FILTERS & COLLECTORS

Fume Control Systems **500**
Literature available on fume control systems. The Kirk & Blum Mfg. Co. p 114.

Dust Collectors **501**
Bull 163-5 describes Norblo portable dust collectors. The Northern Blower Co. p 39.

Dust & Fly Ash Recovery **502**
32-page booklet outlines principles of Multiclone centrifugal dust recovery. Western Precipitation Corp. p 145.

Electrical Precipitators **503**
Bull FA contains data on Cottrell Precipitator. Research Corp. p 56.

Dust Collectors **504**
Information on Aerotec series mechanical-electrical dust collectors. The Thermix Corp. p 32.

ANTI-CORROSIVE & PROTECTIVE COATINGS

Rust Preventive **505**
Page 47 contains coupon for complete information on Rust-Oleum sealing compound. Rust Oleum Corp.

BOILERS & BOILER ACCESSORIES

Steam Generators **506**
Information on Erie City steam generating equipment. Erie City Iron Works. p 143.

Boilers **507**
Complete data available on Wickes boilers. The Wickes Boiler Co. p 57.

Damper Regulators **508**
Coupon on p 150 lists Bull 4-A on damper regulators; also other products. Atlas Valve Co.

BUILDING HEATING, VENTILATING, AIR CONDITIONING & REFRIGERATION

Air Handling Equipment **509**
Information on heating, cooling, drying, air conditioning and air handling equipment. American Blower Corp. p 30.

BUILDING MATERIALS & MAINTENANCE

Iron Cement **510**
Free Repair Handbook describes Smooth-On repairs. Smooth-On Mfg. Co. p 162.

Thread Compound **511**
Free sample and data sheet on Fel-Pro C-5 "Hi-Temp" thread compound. Felt Products Mfg. Co. p 154.

COAL, ASH & BULK HANDLING

Vibrating Feeder **512**
Bull 134 contains complete data on Hewitt-Robins Vibra-Feeder. Hewitt-Robins, Inc. p 134.

Coal & Ash Handling Machinery **513**
Information on complete line of material handling, processing and mining equipment. The Jeffrey Mfg. Co. p 43.

Ash Removal Systems **514**
Information on National pneumatic steam ash removal systems. National Conveyors Co., Inc. p 152.

Electric Vibrators **515**
Free illustrated folder available on Syntron electric vibrators. Syntron Co. p 146.

Conveyor Belting **516**
Conveyer belt manual contains data on NYB&P complete line. New York Belting & Packing Co. p 13.

Pulverizers **517**
Illustrated catalog contains data on Mikro-Pulverizers. Pulverizing Mach'y Co. p 148.

Coal Handling Equipment **518**
Power Plant Book 2410 describes Peck Carrier and other L-B coal handling equipment. Link-Belt Co. p 3.

Coal Handling Equipment **519**
Bull 300 contains data on 4 G-W basic designs of coal handling. Gifford-Wood Co. p 107.

Conveyor Belting **520**
Free booklet "Production-eering for Industry" contains data on belting, hose, packing & molded rubber products. Quaker Rubber Corp., Div. of H. K. Porter Co., Inc. p 53.

COMPRESSORS

Compressors **521**
Information on compressors ½ to 3000 hp. Chicago Pneumatic Tool Co. p 110.

CONTROLS, REGULATORS & INSTRUMENTS

Regulators **522**
Bull 50-1000 gives details on patented Stacon regulator. Farris Stacon Corp. p 160.

Low Pressure Gages **523**
Bull 49-667 describes complete line of low pressure instruments. The Hays Corp. p 40.

Tank Gage **524**
Details available on Liquidometer tank gage. The Liquidometer Corp. p 162.

Level Control **525**
Bull available on floatless level control for open and pressurized vessels. Leslie Co. p 122.

Angle Thermometer **526**
Bull AA50 describes adjust-angle thermometers. Weksler Thermometer Corp. p 160.

Boiler Feed Regulators **527**
Details available on boiler feed regulators. Henszey Co. p 156.

(Continued on page 134)

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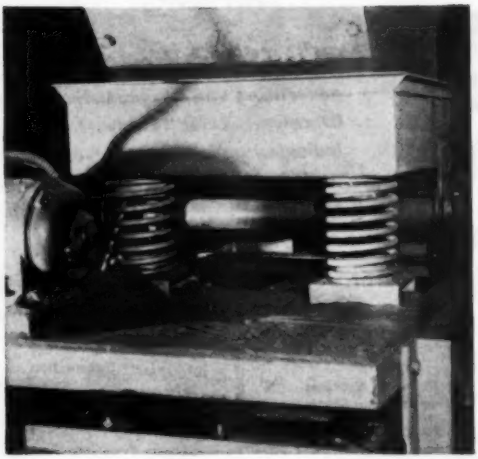
Water Treatment 141

HEWITT-ROBINS



SIMPLIFIES VIBRATING FEEDER PROBLEMS

Hewitt-Robins Vibra-Feeder . . . First Practical Fully Mechanical Vibrating Feeder

Simple To Operate: Completely automatic. Just push a button and start feeding—requires no attention or adjustment—can't be overloaded with standard hopper design—won't dampen out—some sizes draw only 2 amps.

Simple Construction: Vibrating mechanism is *fully mechanical*—small and compact—completely dust-tight—practically noiseless. *Only electricals . . . an AC or DC 1 HP motor and a simple light-duty plug and receptacle.*

Full Range Of Sizes: Available from 24" to 48" wide and 48" to 144" long; also other sizes to meet your specifications.

Write for Bulletin 134 for complete information.

HEWITT-ROBINS (HR) **INCORPORATED**
STAMFORD CONNECTICUT

Hewitt Rubber Division
Hewitt Rextoam® Division
Robins Conveyors Division
Robins Engineers Division

Readers' guide to advertised products

(Continued from page 133)

Regulators **528**
Bull 350 contains details on line of automatic regulating valves. Spence Engineering Co., Inc. p 117.

Thermometers **529**
Catalog shows many types of thermometers. The Electric Auto-Lite Co. p 148.

DIESELS

Diesels **530**
Information on Cooper-Bessemer supercharged diesels. The Cooper-Bessemer Corp. p 129.

ELECTRICAL DISTRIBUTION

Fuses **531**
Price list and catalog on "Economy De-Lay" Renewable Fuses. Economy Fuse and Mfg. Co. p 44.

Deltabeston Cable **532**
Information on G-E Deltabeston AVA cable. Construction Materials Div., General Electric Co. p 58.

Dual-Element Fuses **533**
Coupon for complete facts on Fusetron dual-element fuses. Bussmann Mfg. Co. p 14, 15.

Circuit Breakers **534**
Complete literature available on circuit breakers. Heinemann Electric Co. p 121.

Circuit Breakers **535**
Cat Sec 1003 contains selection and application data on I-T-E large air circuit breakers. I-T-E Circuit Breaker Co. p 26, 27.

Motor Starters **536**
Free booklet with data on Type "RA" motor starters. The Arrow-Hart & Hegeman Electric Co. p 128.

ENGINES

Engines **537**
Information on modern diesels, dual fuel, or high compression gas engines. Worthington Corp. Engine Div. p 63.

FANS & BLOWERS

Heavy-Duty Fans **538**
Cat 901 contains information on Type RT heavy-duty fans. Clarage Fan Co. p 4.

Industrial Fans **539**
Cat 400 gives data and specifications on fans and blowers for every industrial and commercial application. Chelsea Fan & Blower Co., Inc. p 136.

Forced Draft Fan **540**
Cat 300 contains data on the Prat-Daniel F. D. fan. The Thermix Corp. p 124.

Exhaust Fan **541**
Information available on Gallaher Air Van power exhauster for expelling moisture. The Gallaher Co. p 154.

Blowers **620**
Bull A-650 describes multistage centrifugal blowers. U. S. Hoffman Machinery Corp. p 147.

FILTERS, STRAINERS & PURIFIERS

Air Line Filter **542**
Page 46 contains coupon for information on Cuno Micro-Klean air line filters. Cuno Engineering Corp.

(Continued on page 136)

How to make packings last longer

Tips by Johns-Manville Engineers to help you keep production rolling

Keep equipment in repair for best packing service

Worn shafts wear me down

Trying to make packing compensate for excessive shaft or rod wear will shorten packing life materially without alleviating the undesirable condition. Pack correctly to avoid excessive shaft and rod wear. Replace worn shafts and rods as soon as possible to avoid adding the expense of damaged packings to the cost of parts replacement.

"Bucking" shafts threw me!

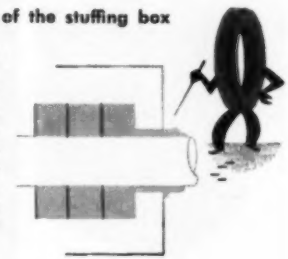
Packings are for sealing only. Trying to compensate for shaft misalignment or vibration by overpacking and excessive gland pressure results in scored shafts and ruined packing. Think of a stuffing box as a potential brake assembly that may develop considerable frictional resistance with attendant heat and wear.

Keep my lantern clear

If the stuffing box is equipped with an oil, grease or water lantern, its purpose is defeated when the lantern ring is omitted or the opening blocked by improperly installed packing or other obstruction. This can deprive the packing of lubrication or cooling and result in premature failure.

Don't let me get out of the stuffing box

If the shaft or rod is badly worn, the packing may be extruded into the system when the gland follower is taken up. Considerable difficulty such as packing getting into valves or traps or contaminating the fluid handled may result. Rebush the stuffing box or use a junk ring to reduce the clearance.



Why you can expect maximum service from

CENTRIPAC ROD PACKING Style No. 7

Made from long fibre asbestos yarn, plaited (not pressed) square, thoroughly lubricated and graphited, J-M Centripac has been, for many years, a preferred high-quality packing for centrifugal pumps and other equipment with rotating or oscillating rods. You can count on it to stand up against water — fresh, salt, hot or cold — oil, ammonia, brine, gasoline and some weak acids and chemicals.

Your distributor will help too! Your J-M Packing Distributor can help you take the guesswork out of packing problems. He carries complete stocks of Johns-Manville quality packings and can supply you promptly. For the address of the J-M Packing Distributor nearest you, write Johns-Manville, Box 60, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

Readers' guide to advertised products

(Continued from page 134)

FUELS & FIRING EQUIPMENT

Stokers 543

Information on all models of Combustioneer stokers, case histories of other users, and details of free heating survey. Combustioneer Div., The Steel Products Engineering Co. p 112.

Coal 544

Complete data on Southern's engineered, industrial coal. Southern Coal Co., Inc. p 41.

Centrafire Stokers 545

Information on Westinghouse Centrafire stokers with Link-Grate. Westinghouse Electric Corp. p 17.

Coal 546

Information available on bituminous coal. Bituminous Coal Institute. p 55.

Over-Fire Air System 547

Technical bulletin on Turbo-Aire overfire air system. Turbo-Aire Div., Canton Stoker Corp. p 105.

Burners 548

Bulletin Series Y and YC contains data on John Zink combination gas and oil burners. John Zink Co. p 111.

Coals 549

Information on Bell & Zoller coals. Bell and Zoller Coal Co. p 125.

HEAT EXCHANGER EQUIPMENT

Aero After Cooler 550

Bulletin contains information on Niagara Aero After Coolers. Niagara Blower Co. p 141.

Deaerators 551

See p 65 for information on Worthington deaerators. Worthington Corp., Steam Power Div.

LUBRICANTS, LUBRICATION, OIL FILTERS & PURIFIERS

Turbine Oil 552

Information on Nonpareil turbine oil. Standard Oil Co. p 51.

Non-Fluid Oil 553

Free testing sample of Non-Fluid Oil for pneumatic tools. New York & New Jersey Lubricant Co. p 146.

Lubrication Systems 554

Data on lubrication, filtration, oil, storage, metering. Bowser, Inc. p 34.

Lubricant 555

Data on Texaco Ursa oil. The Texas Co. p 166.

MECHANICAL POWER TRANSMISSION

V-Belts 556

Information on cog-belts and Thorobred V-belts. Dayton Rubber Co. p 22, 23.

Grommet V-Belts 557

Information on Goodrich Grommet belts. The B. F. Goodrich Co., Industrial Products Div. p 35, 36, 37, 38.

V-Belts 558

Information on Gates Vulco Ropes. The Gates Rubber Company. p 45.

Roller Chain 559

Atlas roller chain described in Fact Book ARC-52HP. Atlas Chain & Mfg. Co. p 42.

Condor V-Belts 560

Bull 6806J contains data on Condor compensated V-belts. Raybestos-Manhattan, Inc., Manhattan Rubber Div. p 59.

Variable Speed Pulleys 561

Catalog and engineering data on Lovejoy Flexible Coupling Co. p 150.

MOTORS & GENERATORS

Steam Turbine Generators 562

Information on Worthington steam turbine generators. Worthington Corporation, Steam Turbine Div. p 64.

PACKAGED STEAM GENERATORS

Superior Steam Generators 563

Cat 402 contains complete details on Superior packaged steam generators. Superior Combustion Industries, Inc. p 130.

Packaged Steam Boilers 564

Illustrated and descriptive Cleaver-Brooks steam boiler catalog. Cleaver-Brooks Co. p 109.

Clayton Steam Generators 565

Catalog contains information on Clayton forced recirculation steam generators. Clayton Mfg. Co. p 123.

Amesteam Generator 566

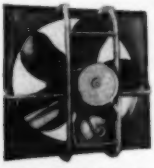
Bull 1011-C contains data on Amesteam generator. Ames Iron Works. p 147.

Preferred Steam Generators 567

Bull 175 describes horizontal rotary oil burner, and bull 1000 describes unit steam generator. Preferred Utilities Mfg. Corp. p 164.

(Continued on page 139)

INCREASE production with CHELSEA INDUSTRIAL FANS



STEP-UP OUTPUT and quality of workmanship, reduce industrial accidents and employee fatigue with proper ventilating and cooling equipment. CHELSEA Fans remove excessive heat, fumes, dirt, dust and grit, also dead stale air. 30 models, in over 200 sizes, are available, and each fan or blower is especially engineered and tested for its recommended application. All ratings are certified by P.F.M.A. test methods to insure proper performance.

TYPE IND EXHAUST FAN For factories, mills, theatres, schools, hotels etc. Features belt drive with ball bearing motor. Sizes from 24" to 72".

Write for Catalog No. 400 Complete data and specifications on fans and blowers for every industrial and commercial application—address Dept. K-5.

CHELSEA FAN & BLOWER CO., Inc. PLAINFIELD, NEW JERSEY

USE ACME ELECTRIC DRY-TYPE TRANSFORMERS TO

- ELIMINATE DOUBLE WIRING
- DISTRIBUTE POWER AT HIGH VOLTAGE
- PROVIDE 3 WIRE SECONDARY CIRCUITS
- OPERATE 120 VOLT EQUIPMENT FROM POWER CIRCUITS
- BOOST VOLTAGE
- BALANCE VOLTAGE
- INSULATE CIRCUITS

Available in sizes 1/10 to 167 KVA, 1 phase 60 cycle; 9 KVA to 500 KVA 3 phase 60 cycle. Class "A" and Class "B" insulation.

Write for Catalogs

ACME ELECTRIC CORPORATION
525 WATER STREET • CUBA, N. Y.

Acme Electric TRANSFORMERS

For range of "availability for duty," you can't beat this small gate valve with the forged steel body and yoke. And it handles *every* job with the same Chapman top standard of performance. Here's why:

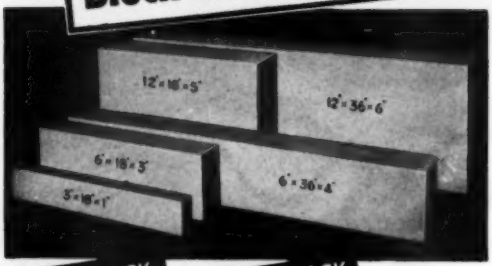
Any *extra stress* more than meets its match in the *extra strength* of the stem and wedge-gate connection. Added life for seat rings and gate faces is obtained by using super-hardened stainless steel. Seizing or galling of seating surfaces is prevented by gates (with certain types of trim) super-hardened by Chapman's *Malcomizing* process to at least 800 Brinell.

You can get List 960 in sizes from ½" to 2", and equipped with rising stem — either with yoke as shown above, or with inside screw. Bonnet joints are gasketed or metal-to-metal. Pressure range: 2,000 lb. at 100°F.—380 lb. at 1,000°F. For higher pressures, specify List 990. Catalog No. 10 is yours for the asking. Write to The Chapman Valve Manufacturing Company, Indian Orchard, Mass.

The CHAPMAN VALVE
Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

R&I Single Layer Block Insulation

Saves 2 Ways



=14 BLOCK

for hot face temperatures up to 1400° F.

=18 BLOCK

for hot face temperatures up to 1800° F.

Saves Labor on Installation

R & I Block applied in any size against refractory surfaces of heat producing equipment—in a single layer of desired thickness instead of in a combination of two different materials—means fewer joints, less bonding, less labor and time to install. It is strong, light, non-crumbling, non-sagging, easy to cut and fit; withstands compression, impact, moisture.

Saves thru Better Insulating Efficiency

R & I Block has remarkably low thermal conductivity; none better for boiler or furnace walls; air or water heaters; turbines, breechings, ducts, tanks and industrial heat processing equipment.

PROMPT SHIPMENT

No waiting for months to get the materials you need now. Quick deliveries. Get our prices and Catalog I-86.

REFRACTORY & INSULATION CORP.

Bonding and Castable Cements • Insulating Block, Blankets and Cements

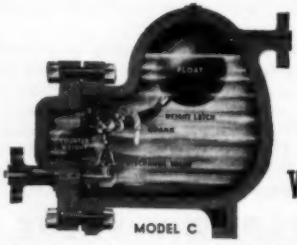
130 WALL STREET • NEW YORK 5, N. Y.
Sales Offices in Chicago, Cleveland, Newark N. J., Philadelphia

Nicholson Weight-Operated Traps are

LEAKPROOF IN SUPER HEAT

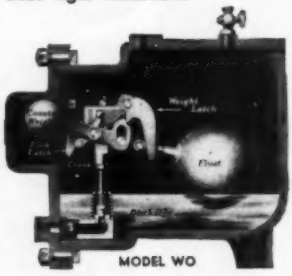
Nicholson weight-operated traps will not leak live steam, even though body may become completely dry due to re-evaporation. Unlike most bucket and float traps, Nicholson units do not depend on buoyancy of float to raise valve. Their extremely large orifices also keep valve clean preventing blow-through. Other Nicholson features: Non-wire drawing; open wide and close tight instantaneously. Rugged for unavoidable abuse. Working parts of stainless steel. Unaffected by pulsation.

CATALOG 751 or see Sweet's



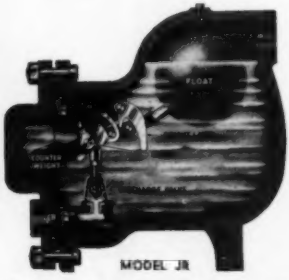
MODEL C

For steam and air pressures to 1500 lbs.



MODEL WO

For steam and air pressures to 650 lbs.



MODEL JR

For steam and air pressures to 200 lbs.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

135 OREGON ST., WILKES-BARRE, PA.

Representatives, in 55 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves

Readers' guide to advertised products

(Continued from page 136)

Packaged Boilers **568**
Bull 1218 contains data on Powermaster packaged automatic boilers. Orr & Sembower, Inc. p 115.

Self-Contained Generators **569**
Steam-Pak's 208-page Architects' Manual is a complete reference on steam generators. York-Shipley, Inc. p 150.

PACKING AND GASKETS

Packings **570**
Information on R/M packings and gaskets. Raybestos-Manhattan, Inc., Packing Div. p 48.

Gaskets **571**
Catalog gives data on Spiralwound gaskets. United States Gasket Co. p 139.

Packings **572**
Information on Johns-Manville packings. Johns-Manville Corp. p 135.

PIPE AND FITTINGS

Flexible Joints **573**
Bulls 215, 265 and 300 contain information on Barco ball, swivel, revolving and swing joints. Barco Mfg. Co. p 153.

Piping Layouts **574**
Piping Layout No. 58 contains detailed information. Jenkins Bros. p 9.

Flexible Metal Hose **575**
Bulls SS-50 and CC-300 contain full details on American flexible metal hose and tubing. The American Brass Co., American Metal Hose Branch. p 54.

Insulated Piping **576**
Information on Ric-wiL prefabricated insulated piping. The Ric-wiL Co. p 142.

Pipe Fittings **577**
Information on complete line of malleable iron and cast iron pipe fittings. Grinnel Co., Inc. p 28.

Flexible Metal Hose **578**
Cat 500 contains data on seamless & interlocking hose in bronze, steel, & stainless steel. Atlantic Metal Hose Co. p 160.

PUMPS

Hydraulic Descaling **579**
Information on descaling hydraulically with BJ hydropress pumps. Byron Jackson Co. p 61.

Chemical Proportioning Pump **580**
Bull 1923 contains data on %Proportioneers% Micro-Shot for proportionate pumping of chemical solutions. %Proportioneers, Inc.% p 128.

Plunger Sludge Pumps **581**
Information on Marlow plunger sludge pumps. Marlow Pumps. p 140.

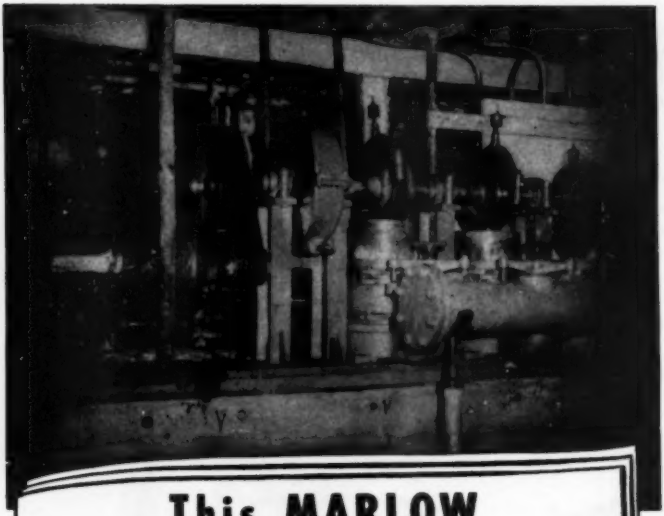
Wheeler-Economy Pumps **582**
See advertisement on pages 30, 31. Wheeler-Economy Pumps.

REFRACTORY CONCRETES

Refractories **583**
Information on B&W Kaocast 3000° re-

(Continued on page 140)

AJAX
Spiralwound Gaskets
Breathe with varying
Pipeline Stress
How much "give" to a dead piece of metal? How much bounce to the ounce of asbestos? Very little!
"spring-loaded"
But with Spiralwound, a "spring-loaded" preformed metal strip with an asbestos filler, you have a gasket that breathes with varying pipeline or boiler stresses. "The Spring is the Thing." It keeps joints tight at low bolt loads, seals irregular, pitted or warped surfaces, has enough resiliency, usually, to be used over again if the joint must be parted.
Get the spring-loaded multiple knife edge contacts of these gaskets to insure safe seals, always. Write for catalog or ask your favorite industrial distributor about them.
UNITED STATES GASKET COMPANY
FABRICATORS OF "TEFLON" & "KEL-F" FOR THE CHEMICAL PROCESS & ELECTRONIC INDUSTRIES
CAMDEN 1 NEW JERSEY

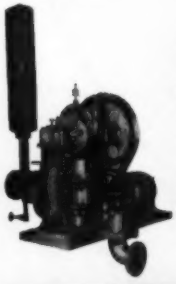


This MARLOW Plunger Sludge Pump Makes Paper "Flow" Smoothly

The Marlow Triplex above is moving semi-chemical neutral sulphite pulp from a stock chest to the beaters. The installation is at Watervliet Paper Co., Watervliet, Michigan.

Two other Marlow Plunger Sludge Pumps handle the long fibre pulp easily and steadily to keep the machine chests at required levels. One of these handles bleached sulphite from the bleach washer to a storage chest. The second pumps deinked and bleached waste paper from a bleach washer to a storage chest.

Marlow Plunger Sludge Pumps have a reputation for doing a beautiful job on bulky, thick, usually troublesome pumpage. They are consistently solving some of industry's most perplexing problems.



In your own industry, if you are concerned with heavy sluggish pumping of any kind, find out about the efficiency and durability of Marlow Plunger Sludge Pumps. And for your other pumping needs ask also about the famous Marlow Self-Priming Centrifugal Pumps — Portable and stationary models — and Marlow Portable Diaphragm Pumps.

Write today for name of dealer nearest you.

MARLOW PUMPS 515 GREENWOOD AVENUE RIDGEWOOD, NEW JERSEY

Manufacturers of the World's Finest Industrial Pumps

Readers' guide to advertised products

(Continued from page 139)

fractory castables. The Babcock & Wilcox Co., Refractories Div. p 21.

Castable Refractories **584**
Information on refractory concrete. Lumnite Div., Universal Atlas Cement Co. p 118.

SOOT BLOWERS & TUBE CLEANERS

Tube Cleaners & Expanders **585**
Data on Airetool tube cleaners and expanders. Airetool Mfg. Co. p 149.

Lagonda Tube Cleaners **586**
Details available on Lagonda tube cleaners. Elliott Co., Lagonda Div. p 157.

STEAM SPECIALTIES

Impulse Steam Traps **587**
Information on Yarway impulse steam traps. Yarnall-Waring Co. p 66.

Steam Traps **588**
Information available on Clark steam traps with Duo-Step double-drainage capacity. The Clark Mfg. Co. p 29.

Water Blenders **589**
Cat 802 contains information on Sarco water blenders. Sarco Co., Inc. p 62.

Blast Traps **590**
Armstrong steam trap book contains information on blast and standard traps. Armstrong Machine Works. p 2.

Weight-Operated Traps **591**
Cat 731 (or Sweet's) describes weight-operated traps. W. H. Nicholson & Co. p 138.

THERMAL INSULATION

Block Insulation **592**
Cat 1-86 and prices available on R&I block insulation. Refractory & Insulation Corp. p 138.

TOOLS

Valve & Bibb Reseater **593**
Page 126 contains data on Skinner valve and bibb reseater. M. B. Skinner Co.

Pipe Tools **594**
50th Anniversary Brochure contains complete information on pipe tools. The Toledo Pipe Threading Machine Co. p 151.

Snap-On Tools **595**
Industrial and general catalogs on Snap-on tools. Snap-On Tools Corp. p 155.

Blower Suction Cleaner **596**
Clements-Cadillac portable blower-suction cleaner. Clements Mfg. Co. p 163.

Proto Tools **597**
Send 10c for 68-page catalog of Proto tools. Plomb Tool Company. p 6.

TRANSFORMERS

Transformers **598**
Catalogs contain data on the application of dry-type transformers. Acme Electric Corp. p 136.

TURBINES

Gearturbines **599**
Booklet B-4346 contains complete data on Westinghouse Gearturbines. Westinghouse Electric Corp. p 33.

Turbines **600**
Bull S-116 contains information on the

Terry Solid-Wheel turbine. The Terry Steam Turbine Co. p 127.

Steam Turbines **601**
Bull SW-51 contains data on auxiliary steam turbines. L. J. Wing Mfg. Co. p 116.

Turbines **602**
Bull 135 describes Coppus steam turbine line. Coppus Engineering Corp. p 101.

VALVES

Blow-Off Valves **603**
Cat 12-D contains information on Edward blow-off valves. Edward Valves, Inc. p 49.

Blow-Off Valves **604**
Bull B-425 and B-433 contain complete information on Yarway seatless blow-off valves. Yarnall-Waring Co. p 102.

Butterfly, Slide Valves **605**
Catalog describes rubber-lined metal valves with manual or automatic control. W. S. Rockwell Co. p 156.

Steel Valves **606**
400-page Cat F-9 on complete Vogt line of drop forged steel valves, fittings and flanges. Henry Vogt Machine Co. p 60.

Diaphragm Valves **607**
Information on Crane diaphragm valves. Crane Co. p 7.

Check Valves **608**
Bull WH-100 contains data on Williams-Hager flanged silent check valves. The Williams Gauge Co. p 152.

V-Port Valves **609**
Information on Powers Flowrite V-Port valves. The Powers Regulator Co. p 25.

Pump Valves **610**
Cat gives 4 ways to cut pump repairs. Sims Pump Valve Co., Inc. p 163.

Gate Valves **611**
Cat No. 10 contains information on Chapman List 960 forged steel gate valves. The Chapman Valve Mfg. Co. p 137.

WATER TREATMENT

Water Treatment **612**
Catalog shows all Penfield equipment. Penfield Manufacturing Co., Inc. p 160.

Return Line Corrosion **613**
Bull 5013 outlines causes of return line corrosion and describes its control. Dearborn Chemical Co. p 113.

Amine Treatment **614**
Bull CP 100 contains all facts on amine treatment. The Bird-Archer Co. p 119.

Antifoam Treatment **615**
Information on antifoam chemicals used as a part of Nalco system water treatment. National Aluminate Corp. p 11.

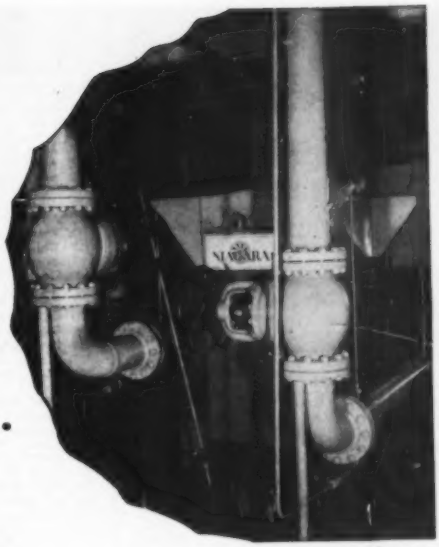
Feedwater Treatment **616**
Free technical article "Boiler Feedwater Treatment for a High-Pressure, High Make-up Power and Steam Producing Plant". Graver Water Conditioning Co. p 52.

Water Treatment **617**
Details available on demineralizing plant for deionized water. Hungerford & Terry, Inc. p 163.

Water Softener **618**
Data on hot process zeolite softener. Cochrane Corp. p 106.

Waste Treatment **619**
Free copy "Chlorine Treatment of Cyanide Wastes". Gilbert Assoc., Inc. p 165.

How to get drier or cooler gases . . .



NIAGARA AERO AFTER COOLER cools a compressed gas, or air, below the temperature of the surrounding atmosphere, thus preventing the condensation of moisture in your lines. The gas will contain only half of the moisture left in it by conventional methods. Even drier gas can be produced if you require it.

In working with controlled atmospheres of inert gases to prevent undesired reactions, this dryness of the gas at low cost is a great advantage. The cost of the Niagara method is low because it uses evaporative cooling, saving 95% of the cost of cooling water (and its piping and pumping). This direct saving of cost pays for the Niagara cooler in less than two years.

If you use compressed air to operate tools or pneumatic equipment you save much in water and oil damage to tools and equipment, and in water damage to materials by using the Niagara Aero After Cooler.

Write for a bulletin, or ask nearest Niagara Field Engineer if you have a problem involving the industrial use of air.

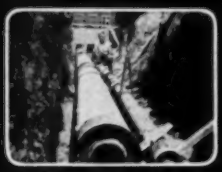
NIAGARA BLOWER COMPANY

Over 35 Years' Service in Industrial Air Engineering

Dept. IP, 405 Lexington Ave. **New York 17, N. Y.**

Experienced Field Engineers in Principal Cities of U. S. and Canada

For
TOP EFFICIENCY
INSULATED
PIPING
SYSTEMS



UNDERGROUND
OR
OVERHEAD

Ric·wiL
is your
BEST CHOICE

For distribution of steam or hot water, oils or process liquids, Ric-wiL Prefabricated Insulated Piping will provide your piping system with maximum sealed-in protection and efficiency.

Architects, engineers, and contractors have long recognized the reliability of Ric-wiL engineering and manufacturing of high-efficiency insulated piping—factors that insure long trouble-free life of industrial, commercial, and residential piping systems.

THE RIC-WIL COMPANY
CLEVELAND, OHIO

Ric-wiL PREFABRICATED INSULATED PIPING
UNDERGROUND OR OVERHEAD

QUICK REFERENCE TO BULLETINS AND CATALOGS OFFERED BY ADVERTISERS IN THIS ISSUE

List "Key Numbers" for literature desired on the postal card on page 131

Page No.	Advertiser	Catalog	Key No.
136	Acme Electric Corp.	Dry type transformers	598
54	American Brass Co., American Metal Hose Branch	Flexible metal hose	575
147	Ames Iron Works	Amesteam generator	566
2	Armstrong Machine Works	Steam trap book	590
128	Arrow-Hart & Hegeman Electric Co.	Type RA motor starters	536
160	Atlantic Metal Hose Co.	Flexible metal hose	578
42	Atlas Chain & Mfg. Co.	Roller chain	559
150	Atlas Valve Company	Damper regulators	508
153	Barco Mfg. Co.	Flexible joints	573
119	Bird-Archer Co., The	Amine treatment	614
14	Bussmann Mfg. Co.	Fusetron dual-element fuses	533
105	Canton Stoker Corp.	Turbo-Aire over-fire air system	547
137	Chapman Valve Mfg. Co., The	Forged steel gate valves	611
136	Chelsea Fan & Blower Co., Inc	Fans and blowers	539
110	Chicago Pneumatic Tool Co.	Compressors	521
4	Clarage Fan Co.	Type RT heavy-duty fans	538
29	Clark Mfg. Co., The	Steam traps	588
123	Clayton Mfg. Co.	Forced recirculation steam generators	545
109	Cleaver-Brooks Co.	Packaged steam boilers	544
101	Coppus Engineering Corp.	Steam turbines	602
46	Cuno Engineering Corp.	Micro-Klean air line filters	542
113	Dearborn Chemical Co.	Return line corrosion	613
44	Economy Fuse & Mfg. Co.	"Economy De-Lay" renewable fuses	531
49	Edward Valves, Inc.	Blow-off valves	603
148	Electric Auto-Lite Co., The	Auto-Lite thermometers	529
157	Elliott Co., Lagonda Div.	Lagonda tube cleaners	586
140	Farris Stacon Corp.	Regulators	622
154	Felt Products Mfg. Co.	Fel-Pro thread compound	511
154	Gailaher Co., The	Air-Vac power exhauster	541
58	General Electric Co., Construction Materials Div.	Deltabeston AVA cable	522
107	Gifford-Wood Co.	Coal handling equipment	519
165	Gilbert Associates, Inc.	"Chlorine Treatment of Cyanide Wastes"	619
52	Graver Water Conditioning Co.	"Boiler Feedwater Treatment for High-Pressure, High Make-up Power and Steam Producing Plant"	616
40	Hays Corp., The	Low pressure gages	523
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163	Hungerford & Terry, Inc.	Demineralizing plant	617
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9	Jenkins Valves	Piping layout	574
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122	Leslie Co.	Floatless level control	525
3	Link-Belt Co.	Coal handling equipment	518
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115	Orr & Sembower, Inc.	Powermaster packaged boilers	548
160	Penfield Mfg. Co., Inc.	Water-treating equipment	612
6	Plomb Tool Co.	Proto tools (Cost 10c)	597
124	Prat-Daniel Corp.	Forced draft fans	540
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53	Quaker Rubber Corp., Div. of H. K. Porter Co., Inc.	"Production-saving for Industry"	520
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56	Research Corp.	Cottrell precipitator	593
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62	Sarco Co., Inc.	Water blenders	589
163	Sims Pump Valve Co., Inc.	Pump valves	610
162	Smooth-On Mfg. Co.	Repair handbook	510
155	Snap-On Tools Corp.	Industrial and general tools	595
117	Spence Engineering Co.	Automatic regulating valves	528
112	Steel Products Engineering Co., Combustioneer Div.	Combustioneer stokers	543
130	Superior Combustion Industries, Inc.	Packaged steam generators	563
146	Syntron Company	Electric vibrators	515
127	Terry Steam Turbine Co.	Terry solid-wheel turbine	600
151	Toledo Pipe Threading Machine Co.	Pipe tools & power pipe threading machines	594
139	United States Gasket Co.	Ajax Spiralwound gaskets	571
147	U. S. Hoffman Machinery Corp.	Multistage centrifugal blowers	620
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60	Vogt Machine Co., Henry	Steel valves, fittings & flanges	606
160	Weksler Thermometer Corp.	Adjust-angle industrial thermometers	526
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159	York-Shipley, Inc.	Architects manual on steam generators	569
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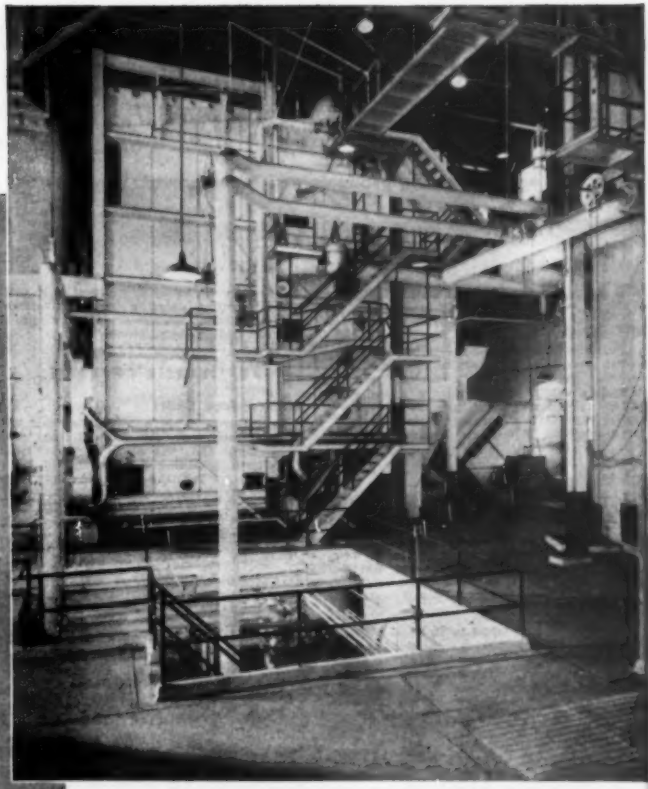


USER*
Sugar Refinery
BOILERS
2 Erie City 2-drum
CAPACITY
150,000 lbs./hr.
DESIGN PRESSURE
450 lbs.
OPERATING PRESSURE
410 lbs.
STEAM TEMPERATURE
570°F
TEMPERATURE OF FEED-WATER
250°F
SUPERHEATERS
Erie City
AIR HEATERS
Erie City
FIRING
Traveling Grate Spreaders
FUEL
Lignite 9000 B.t.u./lb. and Bituminous 11,500 B.t.u./lb.

* Name on request

Sweet Words From Sugar Specialists

Recently an official of this large sugar refinery wrote us:

"We are all very proud of this installation and know that our boilers will meet the high standard of efficiency set by Erie City Boilers. Your personnel should be complimented for the fine workmanship that went into these boilers and the efficient manner in which our order was handled and scheduled through your shop.—This indicates good teamwork in your organization."

Yes, it takes good teamwork by all parties concerned to build good boilers, so whatever your steam requirement consult Erie City, for you can depend on Erie City steam generating equipment.

ERIE CITY
119 Years in Steam Generation

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS

New bulletins and catalogs

Literature on engineering products and developments

Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Insert key numbers on return post card found on page 131

AIR & DUST FILTERS & COLLECTORS

Cloth Type Collector **200**

Bulletin 322 reports the application of cloth type dust collectors to the manufacture of roofing materials. Special attention is given to ventilation of mica and scrap recovery. Photos present case histories and flow diagrams show sequence of operations. American Wheelabrator & Equipment Corp.

Cloth Bag Collector **201**

Features and principles of operation of a high efficiency cloth bag dust collector are described and illustrated in 8-page bulletin 914. Hoppers, hopper valves, structural supports and mountings are also presented. Standard sizes and dimensions are listed. Pangborn Corp.

Cloth Type Collector **202**

If you are concerned with dust collection, 4-page folder 101 should be of interest. Cloth screen collectors, featuring continuous automatic cleaning by reverse air flow, are illustrated. Mechanical shaking is eliminated and uniform suction is said to result. Advantages and how they operate are fully discussed. The W. W. Sly Manufacturing Co.

Gas Scrubber **203**

Six page bulletin 203-B features a gas scrubber to clean, cool or absorb gases. Applications, advantages and operating principles are discussed and illustrated with typical installation photos, cross-section diagrams, and capacity curve sheet. Peabody Engineering Corp.

ANTI-CORROSIVE & PROTECTIVE COATINGS

Maintenance Coatings **204**

Coatings for plant maintenance are described in 4-page folder. Products are listed for skid-proofing, rust prevention, painting over damp areas, weatherproofing and decoration of exterior masonry, interior waterproofing, painting over hot surfaces and protection against acids and chemical fumes. United Laboratories, Inc.

BATTERIES & CHARGERS

Maintenance Chart **206**

Procedures to be followed for basic battery maintenance are tabulated in wall chart form, GB-1450. Rules are established for charging, adding water, cleaning, keeping records, locating, installing and connecting. Five cartoons add interest to the chart. Gould-National Batteries, Inc.

BOILERS & BOILER ACCESSORIES

Blowdown Separators **207**

Advantages of centrifugal blowdown separators are discussed in 4-page folder 30. Diagrams show common methods of installation. Table of dimensions and dimensional drawings are included. Wilson Engineering Corp.

BUILDING MATERIALS & MAINTENANCE

Iron Cements **208**

Suggestions for simple reliable repairs on equipment and piping using iron cement are presented in 40-page pocket-size pamphlet. Iron cements for many uses are described. Patching cement, aluminum and bronze cement, concrete paint, gaskets and clamps are also presented. Also included is a folder describing advantages and how to apply concrete paint No. 18, for interior or exterior use. Smooth-On Manufacturing Co.

COMPRESSORS

Air Compressors **209**

Diesel-powered air compressors are the subject of 24-page brochure 3172-A. A heavy duty, four-cycle diesel engine and a double-acting compressor are combined as a single compact unit. Free air delivery ratings for 100 psi are up to 1450 cfm. Suggested applications are listed and photos show actual installations. Two large illustrations are used for quick reference in listing design and construction features. Advantages, specifications and auxiliary equipment are also presented. Ingersoll-Rand Co.

Portable Air Compressors **210**

Design features and specifications for portable air compressors are presented in illustrated 16-page catalog 5101. Units are available in sizes from 20 to 600 cu ft with gasoline or diesel engine drives. Two wheel, four wheel and skid mountings are shown. Illustrated quick reference chart gives recommended applications and complete specifications for each model size. Schramm Inc.

Air Line Filters **211**

"Dry-Clean Compressed Air," 4-page folder PJL 0549, describes the advantages of filters for compressed air lines. Several models and actual installations are illustrated. Recommended uses are listed and complete specifications are given. The Cuno Engineering Corp.

COAL, ASH & BULK HANDLING

Bin-Level Control **212**

Normal duty, explosion proof and heavy duty bin-level control switches are discussed and illustrated in 4-page folder 11-6. Applications, specifications and wiring details are presented. Stephens-Adamson Manufacturing Co.

Four-Rope Buckets **213**

Users of overhead or bridge type cranes with four-rope bucket trolleys will be interested in 44-page bulletin 2302. In addition to discussions and illustrations of buckets, reeving and sheave bearings, the booklet also presents information on methods of selection and uses of the equipment. Blaw-Knox Co., Blaw-Knox Div.

Coal Storage **214**

Economic coal storage using tractor-scrapers, bulldozers and tractor-shovels is outlined in 8-page bulletin MS-872-5012. Photos demonstrate actual use of equipment. Method of stockpiling to lessen danger of storage fires is diagrammed, and other advantages of the system are described. Illustrations and specifications for several types of tractor equipment are included. Allis-Chalmers Manufacturing Co.

BUILDING HEATING, VENTILATING & AIR CONDITIONING & REFRIGERATION

Power Plant Ventilation **215**

Ventilation and air conditioning for the boiler room, turbine room, switchgear bay and control room of a power plant are discussed and illustrated in 4-page reprint R-9. Title of article is "Ventilation and Air Conditioning at Florida Power's Higgins Plant." The Kuljian Corp.

(Continued on page 146)

Crushers **205**

Crushers for lump materials such as coal, coke, gypsum, lime and metal turnings are described and illustrated in 16-page bulletin 12-C Included is the recently developed Knittel ring type for wet coal and sticky materials. Specifications and dimensions are listed, and drawings show construction. Information on selection of equipment and approximate horsepower required per ton of coal crushed is presented. Auxiliary equipment including conveyer belts and carriers, bin level switches and ball bearings are also included. Stephens-Adamson Manufacturing Co.

No wonder "MULTICLONE" *is the leading name in the centrifugal recovery of dust and fly ash from all types of gases, hot or cold.*

No other mechanical recovery equipment has so many years of dust and fly ash recovery experience behind it . . . or has such uniformly high collecting efficiency . . . or provides so many other money-saving, space-saving advantages as MULTICLONE. The four advantages outlined below are by no means the complete MULTICLONE story, but are typical of the vital savings found *exclusively* in MULTICLONE equipment . . .

in dust and fly ash recovery

MULTICLONE COLLECTORS

***and only Multiclones* give vital advantages like these . . .**

Uniformly High Recovery:

MULTICLONE's multiple *small diameter* tubes—made possible by its exclusive vane design—whirl the dirty gases with greater centrifugal force, thus throwing out not only the large, medium and small particles, but also a high percentage of the *extremely small* particles of 10 microns and less. This, coupled with the fact that there are no pads or filters to become choked with recovered material, results in a more complete recovery of *all* suspended materials from the gas stream.

Space-Saving Compactness:

Plant space costs money—so be sure to check space requirements carefully. As shown in the accompanying chart, the MULTICLONE requires less floor space and less cubic space than any other unit of comparable capacity and performance. Translate these savings into today's high costs for plant space and you readily see the great importance of this one MULTICLONE advantage alone!

Make	Relative Space Requirements In Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.6
Collector B	3.9	3.2
Collector C	6.9	3.9

Long and narrow

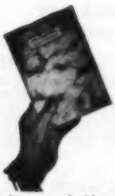
Square

Maximum Adaptability:

In addition to its unusual compactness, the MULTICLONE is also unusually adaptable to various installation requirements. Where head room is low it can be installed with side-inlet side-outlet connections. Where side clearances are restricted, it can be installed with side-inlet top-outlet connections. In addition, without changing capacities, the shape of the unit can be varied—long and narrow, short and wide, or square—to fit restricted spaces . . . and its single-inlet single-outlet duct requirements permit greater flexibility and simpler installation. These savings slice installation costs, space requirements and insulating expense.

Minimum Maintenance:

The MULTICLONE has no high speed moving parts to repair or replace . . . no pads or filters to clean or renew . . . nothing to choke the gas flow or increase draft losses as suspended materials are recovered. MULTICLONE draft losses remain uniformly low *at all times*. Further, the recovered material from an entire bank of tubes is collected in a *single* hopper—far easier to service and maintain than the multiple hoppers of conventional cyclone units.



FREE INFORMATIVE BOOKLET
This 32 page booklet outlines the basic principles of centrifugal dust recovery and shows the many ways MULTICLONE advantages assure higher recovery at lower overall costs. A free copy of this booklet will gladly be sent on request. Write today!

Before you decide on any recovery equipment be sure to get complete information on MULTICLONE advantages. A letter, wire or phone call to our nearest office places this information in your hands without obligation. Get all the facts and you will get MULTICLONE Collectors!

WESTERN Precipitation CORPORATION

ENGINEERS, DESIGNERS & MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1026 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
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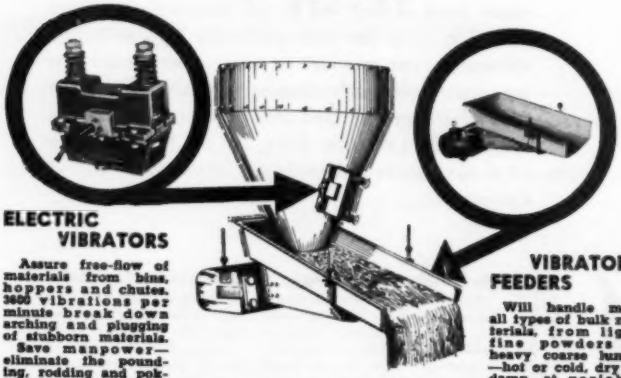
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

SYNTRON

VIBRATORY EQUIPMENT
Simplifies Your Material Handling Problems



ELECTRIC VIBRATORS

Assure free-flow of materials from bins, hoppers and chutes. 3600 vibrations per minute break down arching and plugging of stubborn materials. Save manpower—eliminate the pounding, rodding and poking that damages bins and hoppers and wastes time and materials.

VIBRATORY FEEDERS

Will handle most all types of bulk materials, from light fine powders to heavy coarse lumps—hot or cold, dry or damp, at variably controlled rates from pounds to hundreds of tons per hour.

Write Today For Your Copy of Our Free Illustrated Catalog Folder

SYNTRON COMPANY
425 Lexington Avenue Homer City Penna.

NON-FLUID OIL
TRADE MARK REGISTERED

Tops for "Multiple Greasing"

The increasing use of multiple greasing and conveyor systems of taking grease from drums by means of pump and pipes, have called further attention to the unique properties of NON-FLUID OIL. In multiple greasing and conveyor systems the lubricant is carried from stationary drums through tubes and pipes to many bearings. NON-FLUID OIL Pressure Grades do not separate or leave harmful non-lubricating residues to clog fittings and bearings like ordinary greases.

Write for further information and free testing samples of Pressure Grades of NON-FLUID OIL.

NEW YORK & NEW JERSEY LUBRICANT COMPANY
292 Madison Avenue, New York 17, New York
Works: Newark, N. J.

WAREHOUSES: Atlanta, Ga.; Birmingham, Ala.; Charlotte, N. C.; Chicago, Ill.; Columbus, Ga.; Detroit, Mich.; Greensboro, N. C.; Greenville, S. C.; Providence, R. I.; St. Louis, Mo. Also represented in most other industrial centers, including Cleveland, Ohio; Cincinnati, Ohio; Pittsburgh, Pa.; Syracuse, N. Y.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

New bulletins and catalogs

(Continued from page 144)

Humidifiers **216**

Advantages of humidified air are discussed in 12-page brochure 1773. Several humidifiers are presented, using diagrams to show method of installation. Actual installations are illustrated and described. Information on how to select proper unit is included. Armstrong Machine Works.

Air Diffusers *

If you are concerned with air conditioning, this 64-page selection manual 40 should be a valuable addition to your quick reference file. Air diffusers and accessories are described and illustrated. Performance data and specifications are included, as well as information on actual installations and how to select and install equipment.* **Please send requests on company letterhead directly to Anemostat Corporation of America, Dept. IP, 10 East 39th St., New York, N. Y.**

Unit Heater Maintenance **218**

"The Care and Maintenance of Steam and Hot Water Unit Heaters," illustrated 4-page folder 12, lists proper maintenance procedures for unit heaters. Causes of trouble and their prevention are also presented. Industrial Unit Heater Association.

HOW TO REQUEST FREE BULLETINS

Insert "key" numbers on return post card found on page 131. Our Reader's Service Department will handle your request promptly

Cooling Coils **219**

Booklet DS-365, 2 pages, may make a valuable addition to your engineering data files. Extended surface cooling coils for use with direct expansion refrigerants or chilled water for air conditioning and process applications are fully described. Over 50 pages are devoted to engineering data in the form of selection instructions, specifications, tables, charts and diagrams for selection of the proper design for any air conditioning, industrial or process application. The Trane Co.

Water Blenders **220**

Cold and hot water are automatically blended to any desired temperature by a water blender described and illustrated in 4-page folder 800-A. How they work, specifications and prices are included. Engineering data is presented in graph form, and piping diagrams illustrate applications. Sarco Co., Inc.

CONTROLS, REGULATORS & INSTRUMENTS

Combustion Indicator **221**

Advantages of using a combustion indicator to measure haze or smoke are described in data sheet 801. An electric unit is offered. Specifications and installation data are included. Ess Instrument Co.

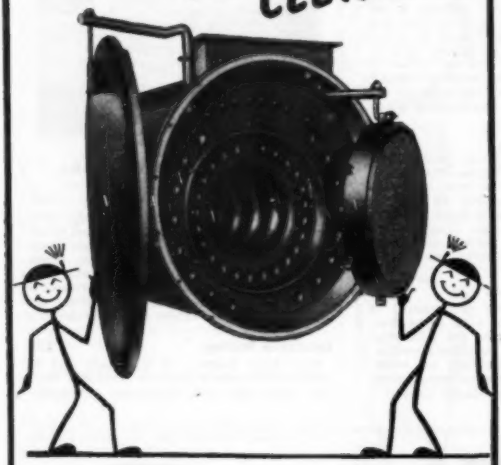
Combustion Controls **222**

Air-operated combustion control systems for gas or oil firing, and their component parts, are presented in 24-page brochure 1023. Diagrams show nine typical firing

(Continued on page 148)

AMESTEAM GENERATOR

EASY TO CLEAN!



To Completely Expose Furnace and All Tubes . . . Open One-Piece Rear Flue Cover, Then . . .

Open One-Piece Rear Baffle. There are Ample Clean-Out Doors in Front End, too!

Nineteen Sizes — 10 to 500 h.p.
15# to 200# w.p.
OIL or GAS

WRITE FOR BULLETIN 1050

AMES IRON WORKS

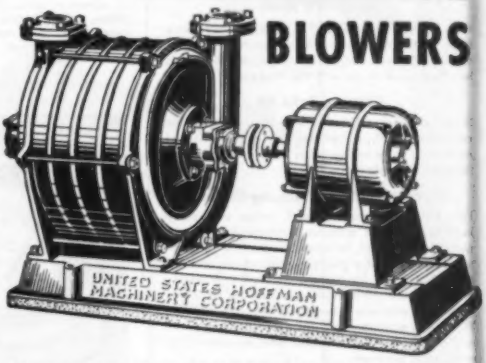
BOX J-5 OSWEGO, N. Y.

Builders of Better Boilers Since 1848

When the Process Demands CLEAN, DRY AIR at constant pressure for

- Municipal activated sludge sewage systems
- Industrial activated sludge waste disposal systems
- Agitation of industrial acid neutralization systems
- Oxidation of industrial wastes for disposal
- Removal of cake from continuous filters
- Blow-back cleaning of sediment filter beds

Specify HOFFMAN MULTISTAGE CENTRIFUGAL BLOWERS



DELIVER AIR ENTIRELY FREE FROM ANY OIL, MOISTURE OR VAPORS. POWER INPUT VARIES WITH VOLUME HANDLED

Built for heavy-duty, continuous service . . . no internal moving parts, no internal lubrication to contaminate air. The standard for a variety of applications in paper mills, plating works, steel mills, textile mills, canneries, rubber plants, chemical works and auto plants. Models for a wide range of pressures and volume, for air or gas. Write for Free Bulletin A-650.

HOFFMAN ALSO BUILDS HEAVY-DUTY INDUSTRIAL VACUUM CLEANING EQUIPMENT IN STATIONARY AND PORTABLE TYPES. *Write for Bulletins*

AIR APPLIANCE DIVISION

U.S. HOFFMAN MACHINERY CORPORATION

100 EAST 42nd STREET, NEW YORK 17, N.Y.

CANADIAN PLANT CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

What PERFECT BALANCE Does:	What PERFECT BALANCE Gives:
• Eliminates vibration.	• Flexibility in installation
• Lengthens life of machine.	• Smoother machine operation
• Permits ceiling suspension (when necessary).	• High constant rate of production

Long Life Span

Many of our first MIKRO-PULVERIZERS, built more than a quarter century ago, are still in active service. Perfect balancing of all moving parts has had much to do with this longevity.

Catalog Tells All

If you are presently confronted with a problem concerned with pulverizing or granulation of materials, write today for a copy of the MIKRO illustrated catalog.

The MIKRO PLAN for Processing Efficiency

This plan has enabled both large and small manufacturers of diverse products to improve quality of product, increase volume and cut both maintenance and production costs. It can also be helpful to you if you have a problem in pulverizing or granulating materials. Just let us know what your problem is and the three-way MIKRO-PLAN will start to work for you. Our engineers will advise the best method and equipment to solve your problem.

PULVERIZING MACHINERY COMPANY
44 Chatham Road Summit, New Jersey

MIKRO-PULVERIZER
ATOMIZER
Also Makers of the MIKRO-COLLECTOR

New bulletins and catalogs

(Continued from page 148)

methods. Facts and figures on 300 installations ranging from 6000 to 1,000,000 lb per hr are listed. Bailey Meter Co.

Heater Safety Control **223**

Design theory of a safety control used in conjunction with fuel oil heaters is described in 6-page bulletin 60 K. The unit is used to detect contaminants in boiler water or condensate. Installation instructions are included, as well as tables of capacity, dimensions and weights. Standard specifications and piping hookups are also presented. Davis Engineering Corp.

Blending System **224**

Construction, operation, advantages, specifications and applications of a system for accurately blending two or more liquids in increments as low as 1/20 per cent are discussed in a 12-page bulletin. Photos and layout drawings illustrate the blender equipment and system, as well as types of installations. Bowser, Inc.

Temperature Regulators **225**

Temperature regulators for control of steam used in equipment such as heaters, tanks and processing units are presented in series of data sheets. Includes specifications, advantages, information on selection, how they work, typical installations and maintenance. Farris Stacon Corp.

Instrumentation **226**

"Fundamentals of Instrumentation for the Industries," 130-page booklet 80-2, should make a valuable addition to your engineering library. Chapters include fundamentals of measurement and control, measurement of process variable, remote transmission of measurements, types of controllers, control systems, and typical applications. Illustrations are used to supplement text. Minneapolis-Honeywell Regulator Co., Brown Instruments Div.

ELECTRICAL DISTRIBUTION

Power Terminals **227**

Power terminals and connectors for wire sizes from No. 6 to 4/0 are presented in 20-page brochure. Also described are tools designed for crimping the terminals. Tools include hand hydraulic, pneumatic and electric-hydraulic types. Includes useful tables compiled to assist in terminal selection. Aircraft-Marine Products Inc.

Insulated Wiring **228**

Four page folder, "20 Questions and 20 Answers on Safety Mineral Insulated Wiring" describes and illustrates character-

Depend on

AUTO-LITE

FOR TEMPERATURE INDICATION

Auto-Lite Thermometers are designed to give you the broadest selection for your needs: Priced low and precision-made for accuracy, these instruments point the way to temperature savings and help to prevent spoilage. Write for catalog showing the many styles and types of Auto-Lite Thermometers that are available.

TYPICAL APPLICATIONS: STORAGE TANKS & ROOMS, COOLERS, DRYERS, AIR CONDITIONING, PILOT PLANTS.

Illustrated, at top: Model G Indicating Thermometer, flush mounting type with capillary tubing for remote reading. Priced from $18. At bottom: Model V Thermometer (vapor pressure type). Rigid stem for direct mounting. Priced from $10.25.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION, DEPT. M-8
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

INDICATING & RECORDING THERMOMETERS

istics and advantages of this wiring system. Table of types, sizes, weights and lengths is included. General Cable Corp.

General Catalog **229**

Rheostats, resistors, relays, starters, contactors and dimmers are listed in 8-page bulletin 100,000. Each is illustrated for quick reference and bulletin for each specific type is listed. Includes brief descriptions of construction features, advantages, applications and specifications. Ward Leonard Electric Co.

Busway Systems **230**

Design characteristics, salient features and application advantages of feeder distribution systems used for lighting, flexible crane and hoist circuits and for portable electric tools are described in 56-page catalog TEB-2. Component parts, layout data, specification and dimensional data are also presented. Trumbull Electric.

Cable Troughs **231**

Standard cable troughs, fabricated from ¾ in. diamond-shaped steel mesh, are described and illustrated in 6-page folder 64B. Standard widths are 6, 12 and 18 in. Fittings are also shown. T. J. Cope Inc.

Circuit Controller **232**

Direct-acting, finger-type voltage and current regulators are analyzed in 12-page bulletin 305.00. Functions and advantages are described as well as applications, principles of operation and performance. How units are used in servo systems is also explained. Electric Regulator Corp.

HOW TO REQUEST FREE BULLETINS

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Switchgear **233**

Low voltage, metal enclosed switchgear assemblies for outdoor and indoor applications are described in illustrated 30-page booklet B-5282. Advantages, features of construction, application data and specifications are included. Current ratings, interrupting ratings, inspection, disconnection and replacement data are also presented. Westinghouse Electric Corp.

ELECTRICAL HEATING UNITS

Radiant Heaters **234**

Electric radiant heaters for use wherever heat is required for baking, drying, curing or dehydrating, are described in 6-page folder CS604. Units are in the far-infrared range. Advantages, construction features and specifications are included. Typical applications are shown. Edwin L. Wiegand Co.

HYDRAULIC EQUIPMENT

Hydraulic Unit **235**

Self-contained, heavy-duty hydraulic linear actuators for applications requiring constant and positive straight line push or pull, either horizontally or vertically, are the subject of 8-page bulletin 551. Specifications and features of the units are presented. Benjamin Lassman & Son.

Solenoid Valves **236**

High pressure solenoid valves suited for all hydraulic systems handling non-corrosive fluids are the subject of an illustrated booklet. Construction features and typical applications are presented. Waterman Engineering Co.

(Continued on page 150)

"turn summer slack into PROFITABLE tube maintenance time with AIRETOOL!"
AIRETOOL forwardly swing arm cleaner is perfect for removing deposits from curved boiler tubes.
Ball bearing type expander with special construction features which reduce friction and produce smooth surfaces in small tubes.
Right angle gear drive for making expanding jobs easy in hard to reach places.

NOW is the time to order in the necessary AIRETOOL tube cleaners, expanders and accessory tools for summer maintenance jobs. Proper attention to the condition of pipe and tubes pays off in extra production and lower fuel costs.

AIRETOOL cleaners and expanders are designed to do your jobs quickly, safely and at low cost. Have a full "crew" on hand ready to go to work the next time you're "down." The AIRETOOL Mfg. Co., 318 S. Center Street., Springfield, Ohio, will send full details.

Just write, wire or phone.

AIRETOOL
MANUFACTURING COMPANY
SPRINGFIELD, OHIO

There's an AIRETOOL Tube Cleaner and Tube Expander for Every Type of Tubular Construction.

BRANCH OFFICES: New York, Philadelphia, Chicago, Tulsa, Houston, Baton Rouge

Representatives in principal cities of U. S. A., Canada, Mexico, South America, England

ATLAS Damper Regulators

ATLAS makes them for all boiler room conditions.

All are hydraulically operated.

Bulletin No. 4-A—our 20-page Data and Price Book on Damper Regulators shows:

No. 501. For low pressure heating boilers.

No. 501-C. Same as above but with Compensating Attachments. Pressures from 5 to 25 pounds.

No. 501-S. For vapor and low pressure heating boilers. Atmosphere to 5 lb. pressure.

No. 502. For boiler pressures up to 150 lb.

No. 503. Cast iron base construction suitable for pressures up to 250 lb. Cast steel base construction suitable for pressures up to 400 lb.

Bulletin 4-A also explains in full what ATLAS damper regulators do and why hydraulic operation is best. Drawings show all parts and how the regulators are constructed. Drawings also show typical hook-up arrangements and regulator combinations. It is a bulletin that is worth studying, using, and keeping in your files.

The coupon below will assist in obtaining Bulletin 4-A as well as data concerning other ATLAS regulating devices. We have been in the regulation business *exclusively* for more than half a century.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

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Represented in Principal Cities

☐ Without obligation, please send "ATLAS" Bulletin No. 4-A on Damper Regulators. Also please send complete information on the following ATLAS products:

☐ CAMPBELL Boiler Feed Regulators
☐ Reducing Valves
☐ Temperature Regulators
☐ Exhaust Control System
☐ Pressure Regulators
☐ Pump Governors
☐ Humidity Controllers
☐ Thermostats
☐ Balanced Valves
☐ Control Valves
☐ Oil Control Cocks

Name .....
Firm .....
Address .....

New bulletins and catalogs

(Continued from page 149)

Hydraulic Power Units **237**
Hydraulic units in single, double and combination pump types are described in catalog 400. Units are available with various tank sizes and capacities from .4 to 48 gpm at 1000 psi. Working drawings, specifications and engineering data are included. Rivett Lathe & Grinder, Inc.

FANS & BLOWERS

Blowers & Exhausters **238**
Design and construction features of single and multi-stage centrifugal blowers and exhausters are presented in illustrated 24-page brochure 120-B-14. Advantages, operating characteristics and regulation are given. Actual installations are shown. Roots-Connersville Blower Corp.

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HEAT EXCHANGER EQUIPMENT

Cooling Towers **239**
Packaged redwood cooling towers are described in illustrated 4-page folder 5.9-083. Units are prefabricated for easy assembly. In addition to listing advantages and specifications, the bulletin offers data and charts to aid in selection of equipment. J. F. Pritchard & Co., Equipment Div.

LUBRICANTS, LUBRICATORS, OIL FILTERS & PURIFIERS

Centralized Lubrication **240**
"Studies in Centralized Lubrication," 8-page bulletin, describes and illustrates case histories of lubrication installations on various types of equipment. Advantages and performance are listed. The Farval Corp.

FILTERS, STRAINERS & PURIFIERS

Pipeline Strainers **241**
Use of strainers reduces maintenance cost on such equipment as steam traps, reducing valves, air tools, pumps and temperature regulators, according to 4-page folder 252. Construction features and specifications for self-cleaning pipeline strainers from ¼ to 3 in. sizes are presented. The V. D. Anderson Co.

Duplex Strainers **242**
Design features and specifications for basket type duplex strainers are presented in 4-page folder 14-50. Inverted taper plug cock types are shown in sizes from ½ to 5 in. Disc valve strainers are shown for sizes over 5 in. Coen Co.

Line Type Purifiers **243**
Efficient purifiers for removal of entrained liquids, solids, oil or dirt from steam, vapors or air are featured in 6-page folder 500. The units are designed for vertical or horizontal installation in pipe lines from

JOBS LIKE THESE!

Lovejoy Countershaft Unit controls speed of automatic Spring Coiler

Lovejoy Wide V-Belt Pulley included in design of Tapping Machine

...depend on

LOVEJOY VARIABLE SPEED PULLEYS

Whatever *your* job calls for — you, too, can depend on Lovejoy Variable Speed Pulleys to operate machinery at exactly the right speed. Quickly, easy, finger-tip control — no stops for speed changes. Simple installations on old or new equipment. Shipped from stock for fractional to 8 H.P. duties. And ask about the new, low-cost Lovejoy Tilting Motor Base for fractional motors up to ¾ H.P.

Write now for complete Catalog and engineering data

LOVEJOY FLEXIBLE COUPLING COMPANY

5043 W. Lake St. Chicago 44, Ill.
Also Mfrs. of Lovejoy Universal Joints and Lovejoy Flexible Couplings

½ to 2 in. diam. Operation, advantages, dimensions and applications are discussed and illustrated. The V. D. Anderson Co.

FUELS & FIRING EQUIPMENT

Fuel Oil Additives **244**

Problems concerning the burning of modern fuel oils and the application of additives are the subject of a technical folder. Data and information on elimination of sludge, soot and slag in the burning of industrial fuel oil are presented. E. F. Drew & Co., Inc., Power Chemicals Div.

Oil Burners **245**

Oil burners with capacities from 5 to 60 gpm are described and illustrated in 8-page catalog AD-102. Heavier grades of fuel oil, up to No. 5, can be utilized. Lists construction features, advantages and specifications. Cleaver-Brooks Co., Hev-E-Oil Burner Div.

Spreader Stokers **246**

Construction details and specifications for spreader stokers are presented in 16-page bulletin SB-42. Dumping grate and

continuous ash discharge types are featured. Photos show component parts. Side elevation drawings show actual installations. Erie City Iron Works.

MOTORS & GENERATORS

Induction Motors **247**

Vertical induction motors, widely used for pumps and other vertical drives, are presented in 4-page folder 05B7629. Construction features for several types from 60 to 800 hp and larger are included. Allis-Chalmers Manufacturing Co.

Fhp Motors **248**

General descriptions of characteristics, details of design and applications for completely redesigned series of fractional horsepower motors are contained in 4-color, 16-page booklet GEA-537. A quick reference illustrated chart shows the styles available for specific purposes. General Electric Co., Apparatus Dept.

Variable Speed Units **249**

Variable speed motor drives are described in 16-page bulletin 1515-100M. Typical uses, advantages and performance characteristics are listed, and photos are employed to show installations. Construction and design features are discussed and illustrated with cutaways and cross section drawings in 4 colors. Speed can be increased as much as 700 per cent. Units with speeds from 1 to 10,000 rpm are listed from ¼ to 50 hp. U. S. Electrical Motors Inc.

Induction Motors **250**

Design and application features of steel frame a-c induction motors from 20 to 700 hp are described in 20-page booklet B-4731. Separate sections describe and illustrate construction of motor frames, end brackets, stators, rotors and bearings. Ventilation system is also discussed. Standard

(Continued on page 152)

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Toledo

LEADER IN PIPE TOOLS FOR 50 YEARS

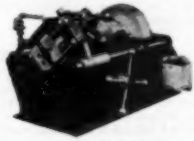
Toledo leadership started a revolution in pipe tools 50 years ago . . . inventing easy-threading tools with receding die segments instead of solid dies.

You've heard it said, "There's no substitute for experience"—and this has a two-way meaning to countless thousands of mechanics who are long-time users of Toledo Pipe Tools.

Experience of the man on the job has shown that Toledos are tools he can trust! Easy handling . . . accurate threading . . . time-saving . . . high production tools that produce *leak-proof joints* and *reduce costs!*

50 years of experience at the Toledo factory keeps the entire line of Toledo Pipe Tools, Power Pipe Machines and Power Drives *steadily improved* . . . always out-front in performance and dependability. May we send you our 50th Anniversary Brochure telling how pipe tools can serve you better? Write . . . The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

Toledo No. 999 2" Power Pipe Machine.



Toledo Simpet, 1" to 2" threader.

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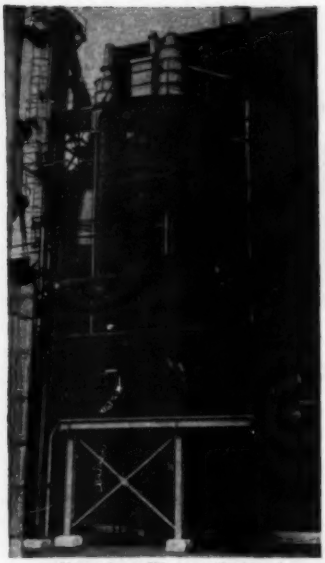
PIPE TOOLS . . . POWER DRIVES . . .
POWER PIPE MACHINES

Factory and General Offices at Toledo.



A "National" installation for American Cyanamid Co. plant at Bridgeville, Pa.

ASH REMOVAL the NATIONAL way assures you low-cost, dependable service

Are ash removal costs a factor in cutting your profits? We suggest a survey by a National engineer. It will cost you nothing. It may avoid wasted dollars.

NATIONAL PNEUMATIC STEAM ASH REMOVAL SYSTEMS

save money in two ways—

1. Exceptionally easy one-man operation cuts labor cost to the bone.
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A complete and effective service policy and a reputation for delivering satisfaction are extras that go with NATIONAL installations.

NATIONAL CONVEYORS COMPANY, INC.

50 CHURCH ST., NEW YORK 7, N.Y.

Manufacturers of The National ChipVeyor System For Metal Turnings—Furnace Doors—Feeders—Ash Gates and Related Equipment.

New bulletins and catalogs

(Continued from page 151)

and special mountings and enclosures are described. Photos show actual installations in many industries. Westinghouse Electric Corp., Motor and Control Div.

Explosion-Proof Motors **251**

Construction details of explosion proof motors are described in bulletin 51B7286A. They are available in non-ventilated types from ½ to 2 hp, and in fan-cooled types from 3 to 100 hp. They are Underwriters' approved for use in Class I, Group D, and Class II, Groups F and G atmospheres. Allis-Chalmers Mfg. Co.

Motors **252**

Illustrated 20-page catalog 174 contains information on variable speed drives, geared motors and constant normal speed motors in drip-proof, splash-proof, totally enclosed and pipe ventilated designs. Advantages, details of construction and specifications are included. Sterling Electric Motors, Inc.

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MECHANICAL POWER TRANSMISSION

Overload Clutches **253**

Overload release clutches are featured in 16-page bulletin ORC-52. Types described include: combination clutch and flexible coupling; reversible; with cutoff switch; automatic reset with cutoff switch; lateral rotating and stationary; and lateral with flexible coupling. Specifications are included. Overload Release Clutch Co., Inc.

Speed Reducers **254**

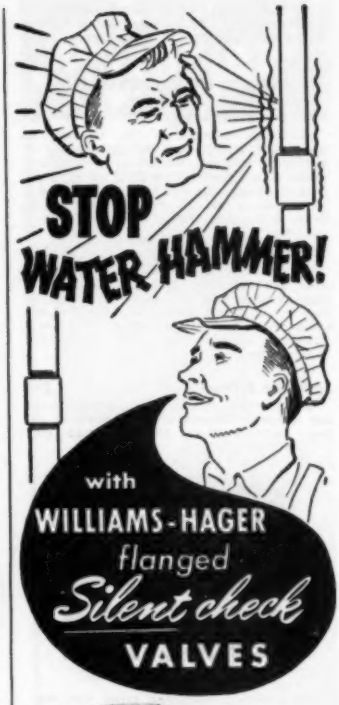
Description of double worm and helical-worm gear speed reducers are contained in 48-page bulletin G-WWH. Data are included on horsepower, output torque and center distances for reductions up to 6400:1. Information on how to select gearing, examples of selection, horsepower rating tables, dimension sheets and complete physical data add to the booklet's value. De Laval Steam Turbine Co.

V-Belt Drives **255**

V-drive selections can be made quickly and accurately with the aid of engineering guide 50-A. Formulas for standard quarter-turn and V-flat drives are augmented by tables of drives for all belt sections, compiled for quick selection of required ratio and speed. Also contains information on other types of V-belt drives. Fort Worth Steel & Machinery Co.

Bearings **256**

Information on bearing load computation and charts of load formulas are contained in 136-page bearing selection guide. Factors influencing bearing selection are analyzed and examples are given covering their use in determining load. Sections of the book are indexed for quick reference. One section is devoted to engineering data. Others deal with bearing types, such as ball bearing, full roller and cageless guided roller. McGill Manufacturing Co., Inc.



You can install Williams-Hager flanged Silent Check Valves in your water system in any position . . . horizontal, angular, vertical with flow upward or downward . . . and put an end to costly and annoying water hammer. Easy to install or reseat without special tools, they are durable and compact with easy accessibility and low friction. Available in standard pipe sizes from 1" to 20". Investigate the many features of these valves . . . and save!

CHECK VALVES

Write for Bulletin WH 851

Write today for your copy of this informative bulletin on Water Hammer, its Cause, Effect and Control in Piping Systems.

THE WILLIAMS GAUGE CO.

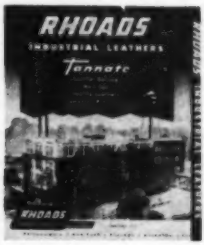
3100 PENNSYLVANIA AVE. • PITTSBURGH 33, PA.

Leather Belting **257**

How leather belts are produced and tested is told in 40-page booklet 101. Leather belting described includes flat, flat-link, round, block-V, solid-V and laminated-V types. Also presented are lacings, dressings, cements and motor bases. Of particular value are chapters on required maintenance, how to make cemented laps, use of automatic clutches and use of motors and controls. Tables on horsepower ratings, belt speeds, how to find belt lengths, and motor data are also included. Graton & Knight Co.

Leather Belting **258**

Series of data sheets enclosed in filing folder describe leather products used by industry. Includes specifications for: flat and round belting in various grades for special purposes; packing for hydraulic and pneumatic equipment supplied as cup,



flange, V and U leathers, as well as discs; and strapping including check, harness, jack, lug and holdup straps. Performance, advantages, how to order and recommended applications are given. Accessories such as a belting tool kit, belt clamps, stick dressing, cement, lace and fasteners are also presented. J. E. Rhoads & Sons.

PACKAGED STEAM GENERATORS

Steam Generator **259**

Process steam generated at the point of use is possible with a forced recirculation steam generator, according to 12-page bulletin. Units are automatic and self-contained. Gas or oil may be used for fuel. Ratings from 25 to 100 hp are listed. Photos suggest possible applications. Clayton Manufacturing Co.

PACKINGS & GASKETS

Ring Packing **260**

Design features, operational data, installation procedures and suggested dimensions for G-T ring packing are contained in 8-page bulletin MP-68. Commercial applications to pressures of 15,000 psi are possible without extrusion of the packing, according to the booklet. Recommended uses include hydraulic and pneumatic cylinders and valves, welding machines, control units and testing equipment. Greene, Tweed & Co.

PIPE & FITTINGS

Swivel Joints **261**

Ball-bearing swivel joints are illustrated and described in 18-page catalog 51-D. In addition to general purpose models, units for special conditions such as high pressures and temperatures and for handling corrosive liquids are presented. Units such as rotary hose, cementing and circulating hose, marine and barge hose, mud mixing guns and circulating heads are also included. Specifications for each are listed. Catalog is indexed for quick reference. Chiksan Co.

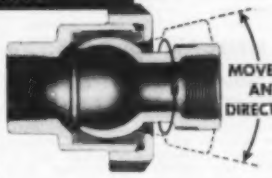
(Continued on page 154)

BARCO *Flexible* JOINTS *to meet* INDUSTRY'S NEEDS

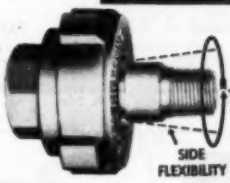
● Wherever piping connections must move, look to BARCO for the ANSWER! Whatever your problem, Barco, invariably, can solve it BETTER, EASIER, and QUICKER with a tested and proven joint right out of the standard Barco line. This is because Barco builds a truly complete line of flexible ball, swivel, swing, and revolving joints—*there is a size and type for every purpose!* Submit your problem; ask for recommendations—Barco is at your service.

FLEXIBLE BALL JOINTS

"One joint does the work of two or more!"—because it moves in any direction. Standard the world over where low cost, leakproof movable joints are needed in piping handling steam, air, water, oil, gas, or chemicals. Many models available. Up to 40° side flexibility plus 360° swivel action. Also used to facilitate quick connection of piping, overcome misalignment. Pressures to 7,500 psi; temperatures to 1,000° F. 15 different sizes, ¼" to 12". *Bulletin 215.*

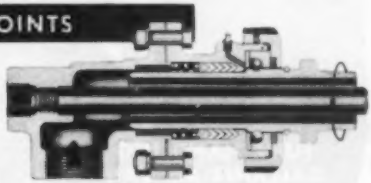


FLEXIBLE SWIVEL JOINTS



Exclusive angular motion prevents binding—only Barco offers this important advantage! Widely used for making compact, low torque swivel connections to reciprocating or rotating parts on platen presses, tire molds, oil burners. Easy to position piping accurately—no sagging, flopping lines. Leakproof, safe—pressure or vacuum. Ratings as high as 600°F., 3,000 psi (hydraulic). Sizes, ⅜" to 2"; angle or straight. Bulletin 265.

REVOLVING JOINTS



Minimum roll "drag" cuts power costs—up to 50% savings! Note wide spacing between bearings; inherent low torque little affected by pressure, speed, or temperature. Parts easily accessible. Light running action minimizes wear, permits free-floating installation. No adjusting necessary—long, leakproof service. Ratings to 250 psi (steam); 450°F. Single flow or syphon styles. Sizes ½" to 3". Wide choice of models; speeds to as high as 2,500 RPM. *Bulletin 300.*

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NEW BULLETINS

For detailed information on Barco Joints, write for latest literature:

Bulletin 215:
"Barco Ball Joints."
Bulletin 265:
"Barco Swivel Joints."
Bulletin 300:
"Barco Revolving Joints."
Bulletin:
"Barco Swing Joints."

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The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Revolving Joints

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

New bulletins and catalogs

(Continued from page 153)

Ball Joints **262**

Flexible ball joints for application wh- ever moving pipes are encountered are described in 20-page catalog 215. Specifications and applications for several types are included. Photos depict actual installations. Service for steam pressures to 750 psi and hydraulic pressures from vacuum to 7500 psi are listed. Units will stand temperatures from —50 to 1000 F. Barco Manufacturing Co.

REFRACTORY CONCRETES

Boiler Settings **263**

Anyone concerned with boiler operation and maintenance should find helpful reference material in 24-page booklet entitled, "Boiler Settings with Plastic and Castable Refractories." Numerous drawings, charts, technical illustrations, applications and other data are presented. Refractory manufacture, design and installation are also described. Ramtite Co., Div. of The S. Obermayer Co.

Refractories & Insulations **264**

Catalogs R-52 through I-93, compiled in binder, form an illustrated 40-page booklet showing where, when and how to use various types of refractory and insulation materials for industrial heat generating and processing equipment. Of particular interest is a table showing how to select proper insulation thickness. Contains helpful suggestions that should aid in solving refractory and insulation problems. An index is included for quick reference. Refractory & Insulation Corp.

Heat Resistant Concrete **265**

Useful engineering data and information pertinent to the structural design of refractory and heat-resistant concrete is contained in illustrated 12-page booklet PP-5M. Subjects such as strength, volume changes, methods of reinforcing, sprung arches and domes, application to ducts, and stack linings are dealt with. Universal Atlas Cement Co., Lumnite Div.

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Refractories **266**

Charts which show at a glance the properties of refractory castables, plastics and mortars are featured in 20-page catalog R-22. All the important information on each type is presented. Photos depict application and end results. The Babcock & Wilcox Co., Refractories Div.

SOOT BLOWERS & TUBE CLEANERS

Tube Cleaners **267**

Air and water driven tube cleaners are described and illustrated in 4-page folder R 105. Heads and accessories are also included. Tables list models for straight and curved tubes. Elliott Co., Roto Div.

Tube Cleaners **268**

Equipment for practically every tube cleaning operation is presented in 28- page catalog Y-29. Specifications for cutter heads, drills, brushes and motors are listed in illustrated tables for quick reference. Cutaways show design features of air, steam, water and electric powered motors. Applications of standard equipment as well as a few special applications are discussed. Accessories such as lubricators, valves, operating hose and couplings are also presented. A section on care and operation of tube cleaners and a table of inside diameters for tubes and pipes add to the booklet's value. Elliott Co., Lagonda Div.

STEAM SPECIALTIES

Water Heaters **269**

Catalog 202, 40 pages, provides a simple, quick means of selecting the correct water heater for forced circulation. Capacities are from 95 to 101,000 gph. Steam pressures are from 0 to 100 psig and water temperatures range from 40 to 100 F inlet, and 80 to 300 F outlet. Booklet, using index tabs for quick reference, includes many useful tables. Patterson-Kelley Co.

Steam Traps **270**

"Installation and Maintenance of Traps," 8-page bulletin 1722, should be a valuable addition to your engineering file. Suggestions for proper installation of steam traps are discussed. Other chapters deal with trouble shooting, maintenance program and lists of traps and repair parts. Armstrong Machine Works.

Steam Traps **271**

Float and thermostatic steam traps for vacuum or pressure service and float type for pressure only are the subject of illustrated 4-page folder 514. Capacities, listed in chart form, are to 3300 lb of water per

Pat. 2188741 2526290

Exclusive scroll effect design, built in assures you of efficient performance against normally encountered static pressures.

Air-Vans are weatherproof and self contained — shipped to your job site completely assembled, ready to install. You get all the economies of direct connection in a superb low silhouette unit. Air Vans have been built to a standard of rugged dependability. Compare Air-Van material specifications and you'll see the difference.

For Catalog Write Dept. I, 4108 Dodge St., Omaha, Neb.

Performance Ratings CERTIFIED by an independent laboratory.
Cap: 150-11,000 CFM: Static Pressures to 1¼".

The GALLAHER Company

NEW THREAD COMPOUND
Licks Stud Freezing Even at 1800° F.!

SAFE for all high temperature applications!
SAFE for Stainless and Alloy Steels, too, will not pit or corrode!
IDEAL as a cutting compound to prevent galling of Stainless Steel!

Make a convincing test of Fel-Pro C-5 "Hi-Temp" Thread Compound at our expense. Then you can be sure that C-5 will do everything we say it will do. See how it cuts heater dismantling time—how it cuts costly stud breakage and eliminates pitting. Then you will standardize on C-5 just as have some of the nation's largest refineries, utilities and process industries. Write for FREE Sample and data sheet TODAY!

FREE TEST SAMPLE! Send for YOURS TODAY

FEL-PRO C-5 "HI-TEMP" THREAD COMPOUND

FELT PRODUCTS MFG. CO.
1542 CARROLL AVENUE • CHICAGO 7, ILLINOIS

hour with pressures to 125 psi. Dimensions, weights and prices are also listed. American District Steam Co., Inc.

TANKS

Floating Roof Tanks **272**

Double-deck floating roof tanks, especially suitable for storage of crudes where corrosion is a factor, are presented in a 12-page bulletin. Operating features are described. Photos show many installations. Graph is included for calculation of average standing losses. Graver Tank & Mfg. Co., Inc.

TOOLS

Tube Expanders **273**

Rolling and flaring tube expanders and operating accessories are listed in illustrated 8-page catalog 68. General information, specifications and recommendations are included. A useful guide for ordering is also presented. The Gustav Wiedeke Co.

Pipe Tools **274**

Pertinent information on power operated pipe and bolt machines, ratchet threaders, reamers, cutters and other pipe tools in the hand and the power classification is given in 28-page 1952 catalog. Four pages are devoted to an instructive operating guide prepared to aid users in obtaining best results from equipment. Drawings and technical discussions quickly tell how to locate and correct pipe tool troubles. Beaver Pipe Tools, Inc.

Hand Tools **275**

Wrenches and hand tools for industrial production and maintenance are presented in catalog 52-I. Drawings show each unit and tables list specifications. Pulling equipment is also listed. Useful table lists all wrench openings for standard bolts and nuts. Snap-On Tools Corp.

VALVES

Corrosion Resistant Valves **276**

Types, sizes, operation and features of corrosion resistant valves are described in 36-page bulletin V-217. Reference is also made to multiport, steam jacketed and power operated valves and their applications to process industries. Tables list approximately 175 chemicals and the alloy valves and lubricants recommended for each. Other sections are devoted to lubricants and lubricant equipment, heavy-duty instrument and gage valves, remote registration, industrial meters and water meters. Rockwell Manufacturing Co.

Cushioned Valves **277**

Cushioned water and steam valves designed for smooth operation to prevent shock, hammer or chattering are described in 8-page bulletin G-3. Valve types include float, reducing, relief and non-return. Golden Anderson Valve Specialty Co.

Bronze Valves **278**

Cutaway views point out design details of composition disc bronze valves presented in a 4-page folder. Globe and angle valves, lift checks, spring loaded check valves, and stop and check valves featuring interchangeability are listed. Specification tables list valve sizes from ⅛ to 3 in. for 150 psi steam, 300 psi air or cold water and 375 psi hydrostatic shell test pressure. The Fairbanks Co.

PUMPS

Chemical Feed Pump **279**

Low capacity pumps for maintenance-free feeding of corrosive solutions are described in 8-page bulletin 1923. Maximum capacity

(Continued on page 158)

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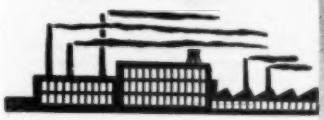

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also MILK EVAPORATORS and PRE-HEATERS

New bulletins and catalogs

(Continued from page 155)

is 2 cc per stroke against pressures up to 50 psig. Two models, a solenoid actuated electrical unit and a diaphragm actuated hydraulic unit, are offered. Typical applications, dimensional drawings, design details and advantages are presented. % Proportioneers, Inc. %.

Centrifugal Pumps **280**

Two instruction booklets covering the installation, operation and repair of centrifugal pumps are offered. Bulletin O3X7813, 28 pages, is for single-stage, single- suction units, while bulletin O3X7780, 52 pages, is for multi-stage pumps. Included are valuable maintenance timetables and a chapter on how to locate and correct trouble. Cutaway and cross-section views illustrate construction features of various types. Allis-Chalmers Manufacturing Co.

Process Pump **281**

Bulletin B-1005, 4 pages, features cutaway view pointing out design details of a heavy duty, horizontal center-line mounted process pump. Units are offered with capacities to 1000 gpm, heads to 625 ft and temperatures to 850 F. Types of drive and materials of construction are listed. Dimensions are also given. Food Machinery & Chemical Corp., Peerless Pump Div.

Sump Pumps **282**

Centrifugal sump pumps, wet and dry pit types, for sewage, clear liquids or liquids containing solids are the subject of

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8-page bulletin WQ-220. Eight sizes from 1½ to 8 in. are offered with capacities to 2000 gpm and heads to 120 ft. Descriptions of pumps as well as specifications and dimensions are presented. Illustrations include photos and line drawings. Approximate pump and motor sizes at various speeds are listed. Warren Steam Pump Co., Inc.

Proportioning Pumps **283**

A high pressure, low capacity, reciprocating plunger pump designed for applications requiring a controlled capacity of fluid, is the subject of a 4-page bulletin. Construction features are illustrated by a cross section drawing. Specifications and application data are presented. Capacities to 14.6 gph are listed for various pressures. Chemical feed packaged unit combining a chemical storage tank and proportioning pump is also presented. The Bird-Archer Co.

Process Pumps **284**

Chemical process pumps for pumping liquids, hot or cold, in capacities up to 1500 gpm and heads up to 231 ft are presented in 8-page bulletin B-1600. Design features, characteristics and dimension tables are included. Food Machinery and Chemical Corp., Peerless Pump Div.

WATER TREATMENT

Corrosion Control **285**

"Organic Methods of Scale and Corrosion Control," 44-page booklet, should be a valuable addition to the engineering file of those concerned with water treatment. Water problems discussed include boiler water, cooling water, steam and return condensate, brines, and pasteurizer and bottle washer water. Control methods, including sampling and proportioning, are described. The properties and uses for glucosides and gluscoside derivatives, used in scale and corrosion control, are fully described. D. W. Haering & Co., Inc.

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Mixed Bed Demineralizer **286**

System consisting of a single ion exchange unit containing a homogeneous mixture of cation and anion exchanger is described in 4-page folder. Advantages and applications are outlined. The Permutit Co.

Water Conditioning **287**

General description and comparisons of numerous water treatment processes are presented in illustrated 16-page booklet. Chapters are divided into treatment for suspended impurities and dissolved impurities including de-ionization. Industrial applications for many industries are listed, including recommended type of water treatment. Paddock Engineering Co. of California.

(Continued on page 159)

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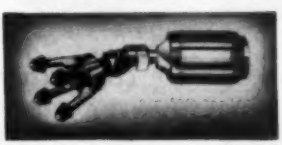
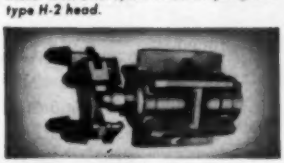
For full details write us, describing the pipe you wish to clean.



Motor with sleeve, universal coupling and type H-2 head.



Sleeved motor and Quick Repair head for large pipe. Can also be fitted with universal joint for curved sections.

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* * *

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THE COMPETITIVE SYSTEM DELIVERS THE MOST TO THE GREATEST NUMBER

New bulletins and catalogs

(Continued from page 157)

Deaerator **288**

Description of a deaerator with internal direct contact vent condenser is given in 4-page folder 3677. Cutaway view is employed to show construction features and principles of operation. The Permutit Co.

Ion Exchanger **289**

Advantages and applications of an alkalinity-reducing ion exchanger which does not require acid for regeneration are presented in data sheet 28X7808. A graphic comparison of water conditioning methods illustrates simplicity of the unit. Allis-Chalmers Manufacturing Co.

Water Conditioning **290**

"Water Conditioning Data Book," an enlarged edition, has been compiled for engineers who work with water conditioning problems. The book, leatherette bound in handy 5 x 7¼ in. size, contains 116 pages presenting engineering data. A few of the subjects covered are hydraulics, impurities in water, chemical conversions, saturated steam, boiler feedwater makeup requirements, chemicals used in water treatment, alkalinity relationships, specific gravities and chemical reactions. The Permutit Co.

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TURBINES

Impulse Turbines **291**

Turbines for mechanical drive are the subject of 8-page booklet 4110-A. Ranging from ¼ to 200 hp, they are of the impulse multiple velocity stage type, and may be used with steam, gas or air. Construction details are discussed and illustrated with photos, cutaways and cross section drawings. Information on principles of operation, general descriptions, applications, material specifications, how to select and how to order is also presented. The Pyle-National Co.

TRANSFORMERS

Tap Changing **292**

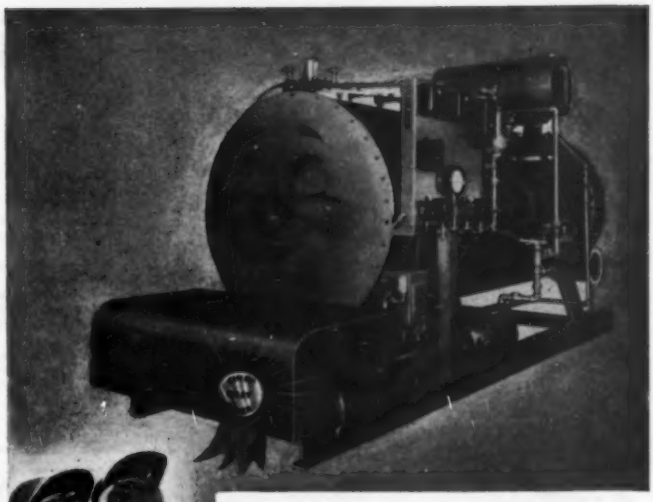
"Parallel Tap Changing Under Load," 8-page reprint 4776, describes the basic methods of parallel tap changing. The latest method, step-by-step switch control, is included. The basis of operation for each method is explained and a chart compares advantages and disadvantages of each. Illustrations of equipment are also included. Westinghouse Electric Corp., Transformer Div.

WELDING & CUTTING EQUIPMENT

Stud Welding **293**

"Maintaining Your Stud Welder," 12-page booklet 1003CC, contains information on how stud gun and controls work, wiring diagrams, causes and corrections for common troubles, maintenance procedures and a list of accessories. KSM Products, Inc.

——End



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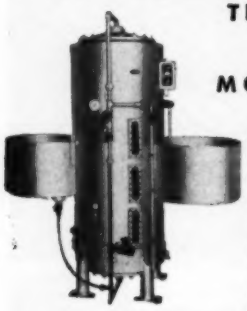

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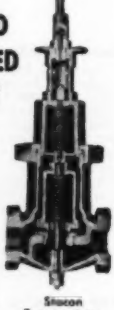

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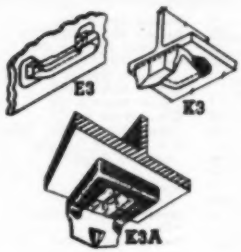

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For your personal reference file, following reprints, free of charge:
"Meeting Gas Curtailment with Propane", April 1952

ERRATA

Valve Positioners, page 78 April 1952. Item 2. Wide throttling range control operations. The third sentence should read as follows:

When the feed is being withdrawn from an accumulator, it is often advisable to minimize the variation in rate of withdrawal by utilizing the entire accumulator control.

"Quaker Designs Plant for Ease of Operation", March 1952
"Practical Considerations in Applying Axial-Flow and Mixed-Flow Pumps", Sept. 1951
"How to Select the Correct Steam Trap", Jan. 1950
"Instruments to Fit the Job", Feb. 1952
"Spicer Finds Answer to Lubricating Large Expensive Machines", March 1952
"Streamlined Steam Plant Insulation", May 1951
"Synchrotie Drives in Process Industries", Oct. 1951
"How to Select Corrugated Expansion Joints", June 1950
"Proper Maintenance Procedure Means Longer Bearing Service", Sept. 1951
"Synchronous Motors Do Two Jobs at One Time", Feb. 1950
"Sprague Electric Meets Steam Demand of Two Plants with Central Unit", Nov. 1951
"Boiler Houses Are Not Necessary Evils", Feb. 1950
"Cooling System Layouts for Best Diesel Performance", Sept. 1951
"Willmar, Minn., Increases Capacity of Municipal Power and Heating", April 1951
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"Warm and Cold Tank System for Multiple Station Cooling", Nov. 1951
"Falls City Production Not Hampered During DC to AC Changeover", July 1950
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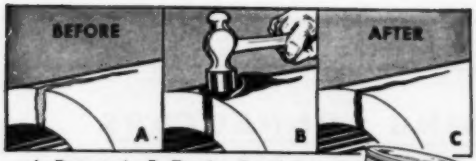
"Proper Water Tower Means Water Conservation", March, April 1951
"Modern Fuel Oils and the Application of Additives", Oct. 1951
"Harbor Plant Pioneers in Pneumatic Build-Up Refractory", Dec. 1950
"Modern System Moves 600 Ton of Coal per Hour", Feb. 1952
"Correct Plans Consider Future Expansion Too", Dec. 1950
"Engineers' Handbook", Volumes 60 and 61, 1951
"Diesels in A Hydroelectric System", June, 1950
"Caribou Diesel Plant Built in a Hurry", Feb. 1950
"Water Conditions and Water Conditioning at Titus", March 1952



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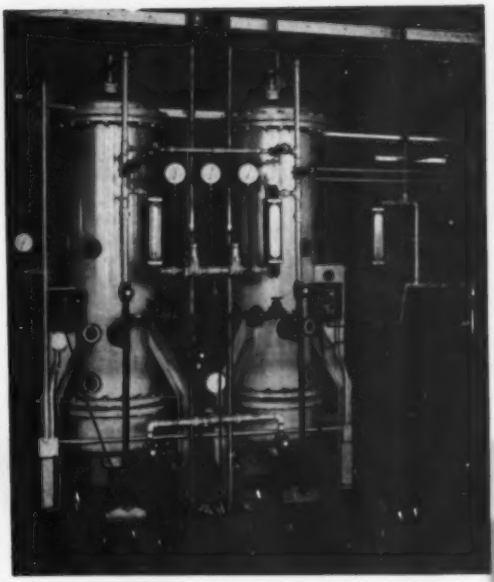

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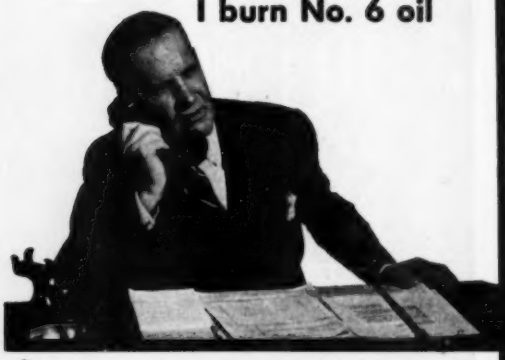

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- Starts *automatically*
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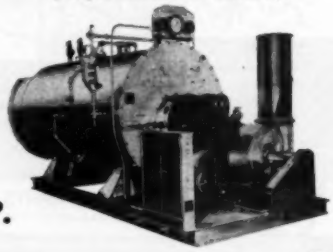
- Starts at low fire and follows load *automatically*
- Shuts off, cleans and purges itself *automatically*.



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PR 204

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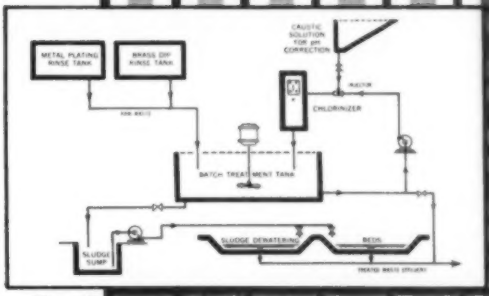

Flow diagram of a batch waste treatment system designed by Gilbert engineers to solve American Screw Company's waste treatment problems.

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